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To the PRACTICAL TEACHER, November, 1894.

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CHEMISTRY NOTES.

BY W. TATE, A.R.C.S., F.C.S.

THE object of these notes is to supply such aid to students acquainted with the simplest rudiments of their subject as will enable them to read the existing text-books profitably. The notes must necessarily be very short, and will generally treat of such matters as have not yet found their way into the ordinary text-books, or are there inadequately discussed. References will be given from time to time to publications in English, which may reasonably be expected to be accessible in well-found public libraries. These references will be, it is anticipated, of considerable assistance to the more advanced students who may, for instance, be reading with a view to entering for the Honours Stage in the Chemistry Examinations of the Science and Art Department, or for the London Degree Examinations. Questions will occasionally be set. Students who write out full answers to these questions will find that their labour will meet with its reward by the greater clearness and precision which their ideas will assume.

TEXT-BOOKS.—The number of the smaller text-books in Chemistry is legion, but very few of these are of such a character as would warrant a chemist in recommending their use to students. No one book treats this subject in a thoroughly philosophical manner and yet presents it within such bounds as to usefully *teach* its principles to the average student. Among the best of the works of moderate size is undoubtedly the recently issued 'Text-book of Inorganic Chemistry,' by G. S. Newth. The information it contains is reliable, clearly presented, and well up-to-date, with but a few trifling exceptions. For a student reading for the second stage examination (S. and A. D.) it is well-adapted. Those taking a somewhat wider range of work should read, in the first instance, 'Chemical Theory for Beginners,' by L. Dobbin and J. Walker, and the 'Introduction to Chemical Philosophy,' by Dr. W. A. Tilden. Later a different view of things may be obtained by studying the 'Text-book of Inorganic Chemistry,' by V. von Richter (trans. by E. F. Smith), and the two volumes of the 'Principles of Chemistry,' by D. Mendeléeff (trans. by G. Kamensky and edited by A. J. Greenaway). Students wishing to acquire some knowledge of Chemical Philosophy farther than the above books supply should read 'Modern Theories of Chemistry,' by Dr. Lothar Meyer (trans. by P. P. Bedson and W. C. Williams), and 'Outlines of General Chemistry,' by Dr. W. Ostwald (trans. by J. Walker). Finally the history of Chemistry is developed in 'A History of Chemistry,' by Dr. E. von Meyer (trans. by G. M'Gowan), and 'Essays in Historical Chemistry,' by Dr. T. E. Thorpe.

HISTORICAL NOTES.—Historical Chemistry is very generally either omitted from the smaller text-books, or only given in the shape of isolated notes, which escape attention. All students should be acquainted with the main outlines of the part played in the development of the science by Boyle, Lavoisier, Dalton, Liebig, and some few others of the more noted chemists. Again, current theories can be better appreciated by one who has some knowledge of the way in which the celebrated 'phlogiston'

theory arose and afterwards became discredited, and who can trace the advances from the dualistic theory of the composition of salts to the unitary theory at present holding sway. The evidence on which was founded the doctrine of chemical proportions, that which led to the atomic theory of the constitution of matter, and the progress of the theory of valency command especial attention. Brief notes on these matters will find a fitting place in our columns.

Robert Boyle was born in 1626 and died in 1691. He first came into notice through the publication at Oxford, in 1661, of a book entitled 'The Sceptical Chymist: or, Chemico Physical Doubts and Paradoxes touching the Experiments, whereby vulgar Spagyrists are wont to endeavour to evince their Salt, Sulphur, and Mercury to be the true Principles of Things.' Many of the facts quoted in this work owed their discovery to Boyle, for instance, the isolation of methyl alcohol from the material condensed on destructively distilling wood, and the preparation of acetone from the acetates of calcium and lead. He was the author of a number of pamphlets, such as his paper on the 'Saltness of the Sea and the Nature of the Sea's Bottom,' and the 'Essay of the Intestine Motions of the Particles of Quiescent Solids wherein the absolute Rest of Bodies is called in question.' He invented the air-pump, and devised numerous experiments to illustrate what he termed the 'Spring of the Air.' He discovered the law that the volume of a gas varies inversely as the pressure. The methods used for the investigation of the composition of substances were much improved by him. He criticised the various meanings attached to the term 'element' among his contemporaries, and rendered good service by limiting the term to the undecomposable constituents of bodies. His experiments on combustion and the formation of calces (oxides) by heating metals in the air gave results of great value, though, unfortunately, they were wrongly interpreted by himself. A corpuscular or atomic theory was brought forward by Boyle, but he did not arrive at quantitative relations between the particles of which he supposed substances to be formed. His influence on the development of chemistry was largely due to his advocacy of experimental methods of enquiry and his aversion to speculations having no basis in the observation of actual phenomena.

Henry Cavendish lived from 1731 to 1810. His work was very thorough and far in advance of that usual in his time, being particularly characterised by its quantitative character. He pointed out that water could be freed from its dissolved chalk by the addition of lime. We owe to him eudiometric methods of investigation of gases; indeed, Cavendish must be regarded as the founder of eudiometry and the chemistry of gases. His researches on inflammable air (hydrogen) proved it to be a gas differing from all others; incidentally he showed that a certain quantity of a metal always yielded the same amount of this gas whatever the acid used, and that the same weights of different metals gave different volumes of the gas. We are indebted to Cavendish also for the knowledge that atmospheric air is a *mixture* of nitrogen and oxygen in constant proportion, for the proof that water consists of hydrogen and oxygen, and for evidence regarding the composition of nitric acid.

Joseph Priestley was born in 1733, and terminated his very busy life in 1804. He was a most voluminous writer; a catalogue of his works drawn up after his death included 108 works, among which History and Theology found place together with publications concerning many departments of science. His chief contributions to Chemistry were connected with the discovery and preparation of new gases. Among those first investigated by him are: nitric oxide, nitrous oxide, carbonic oxide, sulphur dioxide, silicon fluoride, and, most important of all, oxygen. The last mentioned he prepared in 1774 by heating red precipitate (mercuric oxide) by means of solar heat concentrated by the aid of a burning glass. He first isolated hydrogen chloride and ammonia in the gaseous form. To the last he was an ardent supporter of the theory of phlogiston, yet his own brilliant experimental researches supplied much of the material for its refutation.

Practical Notes.—The detection of potassium may be readily and certainly carried out in simple cases as follows: Make a solution of the substance in dilute hydrochloric acid, filter if necessary, and pass a slow current of hydrogen sulphide through the clear hot solution till no further precipitate is formed. Filter, evaporate the filtrate to dryness with ammonium carbonate, and ignite gently; take up with a small quantity of water and repeat the evaporation with ammonium carbonate and ignition; again digest the residue with a little water and filter; concentrate the resulting filtrate to a few drops, add a very little hydrochloric acid, and then a few drops of platinic chloride solution and stir well with a glass rod. The characteristic yellow, heavy, crystalline precipitate of potassium platinum chloride will appear without the addition of alcohol.

The practical difficulty in the certain detection of aluminium in presence of iron and chromium arises from the almost invariable presence of aluminium in the sodium hydrate and sodium carbonate supplied to laboratories. This difficulty may be easily met by employing the following process: Dry the precipitate, which may consist of the hydrates of iron, chromium, and aluminium, and mix it intimately with four times its bulk of potassium nitrate; fuse the mixture on *platinum* foil and maintain at a bright red heat for ten minutes; boil the resulting mass in distilled water, and filter off any residue of ferric oxide; the solution will contain potassium chromate, potassium aluminate, potassium nitrite, and undecomposed potassium nitrate; divide into two parts; add to one part a drop of clear litmus solution, just enough hydrochloric acid to redden the litmus, and then a *dilute* solution of ammonia *drop by drop* until the litmus again becomes blue; a flocculent precipitate will appear carrying down the colouring matter of the litmus if aluminium be present (the ammoniacal solution should be boiled if more than the merest excess of ammonia has been added). The aluminate is decomposed on adding the acid, with formation of aluminium chloride, giving the usual reactions, and potassium chloride. The chromate does not interfere with the detection of the aluminium; it may be tested for in the reserved part of the solution by the addition of acetic acid and lead acetate, when a *yellow* precipitate (filter and wash before deciding the colour) indicates the presence of chromium. The precipitate of aluminium, chromium, and iron phosphates may be treated in exactly the same way. Owing to the presence of the phosphoric

acid, the aluminium shows up more readily in this case.

The detection of antimony and tin in the presence of arsenic often becomes a stumbling block in the path of unwary students. If the method here described be rigidly adhered to, no further difficulty should exist in the examination of this sub-group. Suppose a precipitate containing sulphides of arsenic, antimony, and tin, to be undergoing the process of washing. The presence or absence of tin may be readily proved by means of a borax bead coloured faintly blue with a trace of a copper salt. A bunsen burner is regulated to give a flame, rendered steady by its chimney, showing about one quarter of an inch of luminosity at the tip of the inner cone. The prepared copper bead is held in the reducing (luminous) flame for one minute; it will on cooling show no signs of red, even as streaks, although it may have become nearly colourless. The cool bead is dipped into the wet mixed sulphides, care being taken that a small portion of the precipitate adheres on its withdrawal; it is then strongly heated in the outer *oxidising* flame, until it assumes the original pale blue colour on cooling. This blue bead is again held for one minute in the luminous tip of the reducing flame; it will assume a red colour on cooling if tin be present, opaque if there be much tin, and only showing red streaks for traces only of tin.

Antimony may be specially examined for in the same sulphides precipitate by the very excellent film test here described. Wrap an asbestos thread round the end of a stout wire, and take up a portion of the wet mixed sulphides on the asbestos. Support a porcelain basin filled with water just above the extremity of a colourless bunsen flame. Burn off the sulphides completely from the asbestos holder; the oxides formed should, in part, collect as a dull, almost invisible, white sublimate on the lower surface of the basin. Remove the basin, moisten any white sublimate with solution of silver nitrate, and expose the moistened part to the fumes from concentrated ammonium hydrate. A black stain, insoluble in concentrated AmOH, indicates the presence of antimony. A yellow stain, readily soluble in AmOH, indicates the presence of arsenic.

The precipitate of mixed sulphides has been in the meantime thoroughly washed; it is now treated with hot concentrated HCl and filtered. The filtrate contains the antimony and tin as chlorides; it is freed from H_2S by boiling and divided into two parts; the one part is boiled with copper turnings, and the clear liquid added to a solution of mercuric chloride; a white heavy precipitate indicates the presence of tin; the antimony does not interfere, and is itself sought for in the second part by placing the solution in a basin with a strip of platinum foil in contact with a piece of pure zinc; a dark brown stain on the platinum indicates the presence of antimony. The evidence of this test is much inferior to that given by the film test described above. The undissolved residue from HCl consists of arsenious sulphide; it may be washed, and its nature confirmed by drying and heating in a bulb tube with KCN; a lustrous black mirror burning off with a garlic odour is sufficient to prove the presence of arsenic.

References.—The article 'Analysis,' in the new edition of Watts' 'Dictionary of Chemistry,' Vol. I., pp. 215–259, should be invaluable to students of Practical Chemistry.

In the same volume, 'Allotropy,' by Lothar Meyer, pp. 128–131, can be read by all with profit, the less advanced students confining themselves to the part headed 'Allotropy of the Elements.' The technology (including methods of manufacture) of ammonia, bromine, and chlorine, is fully set out in the articles by G. Lunge, in Thorpe's 'Dictionary of Applied Chemistry,' Vol. I.

Brin's oxygen process is described on pp. 85–87 of Thorpe's 'Dictionary of Applied Chemistry,' Vol. III.

Questions. *Advanced Stage.*—(1) What weight of hydrogen might be prepared by the action of a cwt. of iron nails upon steam in a red-hot tube, supposing the chemical change to be complete? (1893). (2) The specific heat of a certain metal is 0·031; what is approximately its atomic weight? What other facts would be required in order to establish its atomic weight with accuracy? (1894). (3) An unknown volume of hydrogen sulphide required 157 c.c. of chlorine for complete decomposition. What was the volume of the hydrogen sulphide? (1892). (4) One gramme of iron is converted into ferric chloride, and the product is dissolved in water. What volume, at normal temperature and pressure, of hydrogen sulphide is theoretically required to completely reduce the ferric chloride to ferrous chloride? (1891). (5) What weight of air, free from aqueous vapour and carbon dioxide, and containing 23 per cent. by weight of oxygen, is needed to burn 1 ton of coal of the following percentage composition:—

Carbon	81·5;
Oxygen	5·2;
Hydrogen	5·0;
Nitrogen	1·6;
Ash consisting of fully oxidised substances	6·7? (1894).

Advanced Practical.—(1) Describe and explain the effect of adding to solution of ferrous sulphate each of the following reagents:—Ammonium carbonate, ammonium sulphide, nitric acid (1894). (2) Describe and explain the cyanide process for separating nickel from cobalt (1894).

Honours Stage.—(1) One litre of mercury vapour at the standard temperature and pressure weighs 8·923 grammes. On heating 118·3938 grammes of mercuric oxide, Erdmann and Marchand obtained 109·6308 grammes of mercury. On the assumption that mercuric oxide is formed by the union of 1 atom of mercury with 1 atom of oxygen, what light do these facts throw on the atomic and molecular weights of mercury? (1891). (2) The absorption coefficient of nitrogen dissolved in water at 12·6° is 0·0152. What volume of the gas (measured at 0° and 760 mm.) is absorbed by 1 litre of water at 12·6° at each of the following pressures:—1,000 mm., 748·2 mm., 391 mm., and 14·3 mm.? (1892). (3) Write a brief history of the theory of phlogiston, with an account of the discoveries which finally led to its rejection (1891). (4) What influence had the phlogistic theory on the progress of chemistry? Why was the antiphlogistic theory incomplete before the composition of water was known? (1894).

Remarks on the preceding questions will appear in a subsequent issue.

Enquiries concerning chemical matters of interest to students will be replied to in these columns so far as space may allow.

HONOURS PHYSIOGRAPHY NOTES.

BY H. G. WELLS, B.SC. (LOND.),
Fellow (in Honours) and Doreck Scholar of the College of Preceptors.

The Density of the Earth.

An account of Professor C. V. Boys' researches to determine the constant of gravitation, and, consequently, the earth's density, has lately been published. Professor Boys has had the investigation under way since 1889, but it was only in June last that he gave a complete description of the apparatus employed and results obtained at the Royal Institution. His lecture is printed in *Nature* of August 2, 9, and 23.

The principle of the experiment made by Cavendish to determine the earth's density is explained in 'Advanced Physiography,' p. 94. Cavendish measured the force of attraction between two balls of lead, one 12 inches and the other two inches in diameter, and with their centres 8·85 inches apart. The same experiment has since been made by Reich, by Baily, and in recent years by Cornu and Baille with greatly superior apparatus of one quarter of the size. Professor Boys reduced the dimensions of the apparatus to one-eightieth. Cavendish had a force equal to $\frac{1}{8850}$ grain's weight to measure; Professor Boys had less than a five-millionth. But one advantage gained by the use of small apparatus is the increased sensibility, that is to say, the greater angle of deflection produced by the attractions, when the period of oscillation of the beam connecting the attracted balls is the same. The greatest advantage, however, is that there is much less disturbance from air currents than when large apparatus is employed. Instead of the massive lead balls used by Cavendish, Professor Boys employed lead balls 4¼ and 2¼ inches in diameter. The two spheres which were attracted by these balls were made of gold, and the minute beam connecting them was suspended by fine quartz fibres. Both the lead and the gold balls were perfectly spherical in form, and homogeneous. The gold balls were 0·2 and 0·25 inch in diameter. A very light mirror was fixed vertically to the beam carrying these balls, so that when the balls were attracted, and the beam was consequently deflected from its position of rest, the mirror was also turned. The movement of a slit of light reflected by the mirror thus enabled the deflection of the rod carrying the balls to be determined. Measurements made with this apparatus led Professor Boys to conclude that the mean density of the earth is 5·5270 times that of water.

The following table, from Professor Poynting's recently published book, 'On the Mean Density of the Earth,' shows the results previously obtained :—

Approximate date.	Experimenter.	Method.	Resulting Density.
1737–40	Bouguer	Plumb-line and pendulum	Inconclusive
1774–76	Maskelyne and Hutton	Plumb-line	4·5–5
1855	James and Clarke	,,	5·316
1821	Carlini	Mountain pendulum	4·39–4·95
1880	Mendenhall	,,	5·77
1854	Airy	Mine pendulum	6·565
1883	Von Sterneck	,,	5·77
1885	Von Sterneck	,,	About 7
1797–98	Cavendish	Torsion balance	5·448
1837	Reich	,,	5·49
1840–41	Baily	,,	5·674
1852	Reich	,,	5·583
1870	Cornu and Baille	,,	5·56–5·50
1879–80	Von Jolly	Common balance	5·692
1878–90	Poynting	,,	5·493 (5·46–5·52)
1884	König, Richarz, and Krigar Menzel	,,	In progress
1886–88	Wilsing	Pendulum balance	5·579
1889	Laska	,,	In progress

Variations in the Number of Meteors.

The average number of shooting stars observable increases from the evening to the morning hours. This increase is due to the rotation of the earth and to the fact that the front of the earth in her orbital motion encounters more shooting stars than the back, as the front of a man's hat who moves through rain will get wetter than the back, and this in proportion to his speed. Mr. George C. Bompas, in an important paper in the June number of the Monthly Notices of the Royal Astronomical Society, explains this horary variation of meteors, and brings out some new points with regard to a semi-annual variation. At 6 p.m., he says, the spectator stands at the back of the earth, and looks back on the track already traversed. The earth's rotation carries him round hour by hour until at midnight he enters the front hemisphere, and is again carried round until at about 6 a.m. he reaches the foremost meridian of the earth in her motion along her orbit. To this chiefly is due the variation in the number of meteors from hour to hour.

'It is a saying of Arago,' wrote Professor A. S. Herschel thirty years ago, 'founded upon observation and confirmed by constant experience in later years, that the earth encounters more shooting stars in going from aphelion to perihelion than in going from perihelion to aphelion.' The fact of this semi-annual variation in the number of meteors has since been confirmed by many observers, and has also furnished a subject for much discussion. Mr. Bompas criticises the explanation believed to account for the facts of observation. The theory accepted by most observers is that the semi-annual variation referred to is due to the planetary motion of the earth, just as the horary variation is due to the earth's rotation. It will at once be seen that observations in the southern hemisphere supply a test of the validity of this explanation; for the greater number of meteors should appear in the southern hemisphere from January to June in each year—that is, when that hemisphere is in front of the earth's orbital motion. From June to December, when the northern hemisphere is in front, we encounter a larger number of meteors than during the first half of the year. There can be no doubt that the change in the position of the earth's axis relatively to her motion does really tend to increase the number of shooting stars seen in the second half of the year in the northern hemisphere, but Mr. Bompas thinks that this cause is insufficient to account for the very large increase observed, viz., from two to three times the number observed in the first half of the year. He has examined the meteor observations made by Dr. Neumayer at the Melbourne Observatory from 1858 to 1863, and he finds that the variation is not reversed, but follows the same law as in the northern hemisphere, the hourly number of meteors seen in the second half of the year exceeding the number seen in the first half. It seems, therefore, that some cause further than that hitherto assigned must help in producing the semi-annual variation of meteors. The whole discussion leads Mr. Bompas to submit: (1) That the explanation hitherto adopted of the semi-annual variation of meteors is inadequate; (2) that the variation is connected with and mainly due to the cosmical motion of the solar system; (3) that it renders highly probable the cosmical origin and motion of meteors.

The Distribution of Nebulæ and Star-Clusters.

Mr. Sidney Waters has mapped all the nebulæ and star-clusters contained in the standard catalogue, with the object of showing their distribution in the heavens. The maps are published in the Monthly Notices of the Royal Astronomical Society for June. They show that star-clusters are most numerous near the Milky Way; indeed, it is striking to note the fidelity with which they follow out not only the main track of the Milky Way, but also its convolutions and streams. Nebulæ, however, are most numerous away from the Galaxy, and Mr. Waters points out that the remarkable avoidance of the Galaxy by the nebulæ, although in some points nebulæ reach up to and encroach upon its edges, is equally significant with the coincidence of the clusters with its main track. (See Gregory's 'Advanced Physiography,' p. 218.)

The Velocity of an Earthquake.

From a discussion of the observations of the earthquake which caused so much damage in Constantinople in July, Mr. C. Davison has determined the velocity of the pulsations (*Nature*, Sept. 6th). The earthquake was recorded upon the instruments at a number of observatories, and knowing the distances of these stations from the centre of commotion, as well as the times at which the movements were registered, the velocities could be calculated. The average velocity of the large pulsations, obtained from the different records, was 3·4 kilometres (= 2·1 miles) per second. The depth of the seismic focus, that is, the centre from which the waves spread, has been found to be about twenty-one miles.

GENERAL NOTES.

Protection from Lightning.

The U.S. Weather Bureau has issued a useful circular on protection from lightning, drawn up by Mr. Alex. McAdie. From the statistics collected, it appears that lightning is more apt to strike in the country than in cities, the risk in the country being five times greater than in the city. Lightning rods have a two-fold function—to conduct the charge of electricity to the earth, and to prevent or modify the violence of the discharge by a silent neutrali-

sation of the electrification of the clouds. In order to carry the lightning flash, Mr. McAdie points out that the lightning conductor should offer a line of discharge more nearly perfect, and more accessible than any other offered by the materials or contents of the edifice which it is desired to protect, and, in order to prevent the discharge, the conductor should be surrounded by points. He has something to say with regard to a few of the popular superstitions about lightning. For instance, contrary to the general opinion, there are many cases of lightning striking twice in the same place. Small articles of steel, and mirrors also, have not the power of *attracting* lightning, as is popularly supposed, or of determining the path of discharge. In the way of cautions, it is remarked that it is not judicious to stand under trees during thunderstorms, in the doorway of barns, close to cattle, or near chimneys and fire-places. On the other hand, there is not much sense in going to bed, or trying to insulate one's self in feather beds.

The Transmission of Acquired Character.

Prof. Havelock Charles has made a detailed investigation of the differences between the leg-bones of Europeans and those of the Punjaub people—differences caused by their respective habits of sitting in chairs and squatting on the ground. The habits as to sitting postures of Europeans differ from those of their pre-historic ancestors, the cave-dwellers, etc., who probably squatted on the ground. On the other hand, the sitting postures of Orientals are the same now as ever. These races have retained the habits of their ancestors, whereas the Europeans have not done so. Prof. Charles has found, on the Punjaub child and fœtus, facets on their bones fitting them for postures of rest practised by the Punjaubi. But want of use induces changes in form and size, and the result is that these facets have totally disappeared on the European skeleton. The obvious conclusion is that the markings are instances of the transmission of acquired characters. As a good deal of discussion has been carried on over the question of the transmission of peculiarities, Prof. Charles' investigation has excited great interest. His observations certainly indicate that it is possible for an acquisition to eventually become a permanent possession of a racial type.

The Age of the Niagara Falls.

At the last meeting of the American Association for the Advance of Science, Prof. Spencer described the evolution of the Niagara Falls. According to him, the beginning was a little stream draining the Erie Basin and falling only about 200 feet over the Niagara escarpment. This stream was not over one-fourth the present volume of the great cataract, and consequently was able to excavate the gorge at a much lower rate than at present. During this early history of the river, the waters of the three upper lakes emptied through the Huron Basin by way of the Ottawa River. The height of the Falls has advanced several times, and, owing to this change and the variation in the discharge of the water, retreat of the Falls has varied greatly during changing episodes. The computations of the age have been based upon these changing conditions of elevation and downfall of the river. The first episode, as before stated, represented a small river, with a total fall of 200 feet. This lasted about 11,000 years. Then came another episode, where the height of the Falls was increased from 200 to 400 feet, succeeded by the entire drainage of all the upper Great Lakes. At the same time there were series of three cascades, the lower gaining on the upper, until finally they were all united in one great cataract, much higher than that of the present time. Subsequently, the waters were raised at the head of Lake Ontario so as to bring about the present condition after a lapse of 17,000 years from the end of the first episode. The last or modern episode has lasted 3,000 years under nearly the present conditions. Thus we see that the age of the Falls is about 31,000 years, with another 1,000 years added for an earlier condition not given. It is now 8,000 years since Lake Huron emptied into Lake Erie for the first time, and there is reason to believe that, on account of the rise of the land about the outlet of the latter, in 5,000 or 6,000 years the waters of the four upper lakes will be turned into the Mississippi drainage at Chicago.

MAGNETISM AND ELECTRICITY.

FOR THE ADVANCED STAGE OF THE SCIENCE AND ART DEPARTMENT COURSE.

BY EDWIN EDSER, A.R.C.S.

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It is proposed in these columns to indicate a course of study suitable for those preparing for the Advanced Stage Science and Art Examination in Electricity and Magnetism. Space would not permit of a detailed treatment of the subject; so the plan adopted is to recommend a text book, and in that to prescribe a certain amount to be read per month, at the same time explaining or amplifying those parts which are considered to need this treatment. Finally, questions to be answered by the student will be set.

The book recommended is 'A Text-book of Magnetism and Electricity,' by R. Wallace Stewart, B.Sc.; published by the University Correspondence Press, 13, Booksellers Row, Strand, W.C. Price 5s. 6d.

It is important to bear in mind that the part of science which is most fruitful in the cultivation of the intellect is the grasping and careful following up of principles, and not in any random committal to memory of isolated facts. In what follows, therefore, we shall emphasize the former, and endeavour to dissuade the student from the useless and laborious practice of 'cramming up' tables, etc.

Electrical Attraction and Repulsion (*par.* 6, *p.* 15).—The earlier part of the book contains nothing that will not be readily comprehensible to the student; but a few words to explain the law of attraction as described in this paragraph may not be amiss.

As stated, the magnitude of the force acting between electrified bodies can be expressed as follows:—

$$f = \frac{1}{k}\,\frac{qq^1}{d_2},$$

where f = the force acting, which, when positive, indicates repulsion; k a constant, depending on the medium in which the electrified bodies are placed; q and q^1 represent the quantities of electricity on each body, and d = their distance apart.

A simple explanation of this formula may be given on the principle of *lines of force*. When two bodies attract or repel each other, it is necessary to imagine some sort of mechanism or connection extending between them, by which means the attraction or repulsion is transmitted. As we shall see later, there is ample cause to suppose that it is the *luminiferous ether* which in some way transmits this force; and we can imagine strings of ether proceeding regularly from all points of an electrified body, and extending radially from it into space. Now, suppose we define the *unit quantity of electricity* as that which when placed on a small sphere in air will cause 4π lines of force to thus proceed from it.

It is obvious that, supposing each of these strings to act as an elastic filament, drawing in any body attached to its end, the force of attraction will be proportional to the number of filaments attached to it; in other words, the force of attraction at any point will be proportional to the number of lines of force per unit area at that point.

Now consider the state of the lines of force at a distance from the small electrified sphere. If, according to our previous supposition, one unit of electricity be placed on the sphere, there will be 4π lines of force radiating from it. Now construct about this small sphere as centre a sphere of radius d; then the lines of force will pass normally through this surface and be uniformly distributed over it, and the attraction at any point will depend on the number of lines of force per unit area around that point.

There are 4π lines of force scattered over surface of sphere, of area a; therefore number of lines of force per unit area $= \frac{4\pi}{a}$.

But the area of the surface of a sphere of radius $d = 4\pi d^2$

$\therefore$ number of lines of force per unit area $= \frac{4\pi}{4\pi d^2} = \frac{1}{d^2}$

Considering lines of force as elastic bands, only attractions could be accounted for; but to explain repulsions it is necessary to suppose lines of force extending from one positively electrified body to another similarly electrified, to have the property of extending so as to push the two bodies apart. Exactly the same reasoning applies in this case, so that we reach the generalization that *the attractions or repulsions of two electrified bodies vary inversely as their distance apart.*

If we now suppose q units of electricity placed on one body, there will be $4\pi q$ lines of force radiating from it; consequently the repulsion on one unit of electricity placed at a distance d from it will be $\frac{q}{d^2}$. If we suppose that there are q^1 units instead of one at the point, there will be a force of $\frac{qq^1}{d^2}$, so that we see that the *force between two electrified bodies varies as the quantities of electricity on each.*

Lastly, we come to the consideration of the constant k. This constant, as before stated, depends for its value on the nature of the medium in which the electrified particles are placed. If k be more than one, we might consider the action of the medium either as decreasing the number of lines of force proceeding from the body in the ratio $\frac{1}{k}$, or as weakening the pulling or pushing force of each

line. The former is perhaps the most instructive way of looking at the matter. k is taken as 1 for air.

Finally, then, we have the equation for the force between two electrified bodies, $= f = \frac{1}{k}\frac{qq^1}{d^2}$.

(*Par.* 10, *p.* 25.) The student should carefully work through examples (1–4). To fully understand these examples, and to grasp the meaning of the units used, a few words on physical units may prove useful to the beginner.

There are three fundamental units used in physical measurements, viz., the *centimetre*, the *gramme*, and the *second*, these being the units of *length*, of *mass*, and of *time* respectively.

The *centimetre* is a certain length marked off on a bar of platinum kept at Paris. It was founded on theoretical considerations, but the truth or falsehood of these in no wise affects its value as a practical unit at the present day.

The *gramme* is the mass of 1 cubic centimetre of water at the temperature of 4°C.

The *second* is the unit of time, and is fixed by the time of swing of a pendulum of a given length at a given point on the earth's surface.

From these three units it now becomes necessary to obtain units of force, velocity, etc., which can then be applied to obtain still other units used in physical measurements.

Suppose a body to move uniformly, and that it describes a distance of n centimetres in t seconds, then it evidently describes $\frac{n}{t}$ centimetres in one second.

We now define *unit velocity as that of a body moving* 1 *centimetre per second.*

Force is measured by the alteration of velocity of a body acted on by it. If a body of unit mass be moving with a velocity v, and t seconds afterwards at the velocity v^1, then the alteration in t seconds $= v^1 - v$; $\therefore$ the alteration or acceleration of velocity in 1 second $= \frac{v^1 - v}{t}$. Reasoning as above, we get the definition of the *unit force* (called the *Dyne*) as that force which, acting on a body of unit mass, accelerates its velocity in the direction of the force by 1 unit of velocity per second—that is, by one centimetre per second per second.

This unit force, then, the dyne, is based on mechanical considerations, and has been determined accurately. Thus 1 gramme of matter is attracted towards the centre of the earth with a force of about 981 dynes.

Let us now apply this unit of force to our electrical units. Let us define our unit electrical force as 1 dyne; then it follows that if unit quantity of electricity be placed on each of two small spheres, and placed in air at such a distance apart that the force between them is 1 dyne, we have, substituting in the formula

$$f = \frac{1}{k}\frac{qq^1}{d^2},$$

$$1 = \frac{1}{1} \times \frac{1 \times 1}{d^2} = \frac{1}{d^2}\ ;\ \therefore d = 1.$$

From this springs our definition of *unit quantity of electricity*, viz., *a quantity such that when placed on a small sphere* 1 *centimetre distance from an equal quantity placed on another small sphere, they will repel one another with a force of* 1 *dyne.*

With the above understanding, examples 1 and 2 will be easily solved by the student. No. 3 involves the definition of *unit field*, which is such *that there is* 1 *line of force per square centimetre* at the point, or, what, as already explained, is the same thing, such that a *unit charge placed at that point experiences a force of* 1 *dyne.*

Ex. 5 is not of so much importance; ex. 6 will easily be solved; but exs. 7, 8, 9 require a knowledge of a further principle, viz., the *parallelogram of forces.* The problem referred to is as follows:—

'Two charges of + 10 and — 10 units are placed at two corners of an equilateral triangle of 10 cm. side. Find the magnitude and direction of the resultant force acting on a charge of + 10 units placed at the third corner of the triangle.'

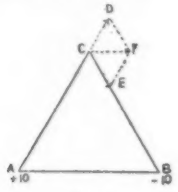

Fig. 1.

Fig. 1 represents the distribution of the charges, + 10 units at A and — 10 units at B. We must now find the magnitude and direction of the force due to these two charges acting on + 10 units placed at C.

Each charge at A and B respectively will exert an independent force on the + 10 units at C; we will now represent these forces in magnitude and direction by straight lines. The + 10 units at A will exert a force at C represented by

$$\frac{(+10) \times (+10)}{(10)^2} = 1 \text{ unit of force, or 1 dyne,}$$

in the direction AC. Let us represent this by the line CD. The — 10 units at B will exert a force on the + 10 units at C equal to

$$\frac{(-10) \times (+10)}{(10)^2} = -1\ ;$$

this we will represent by a line CE, equal in length to CD, but measured along CB. Note particularly that the + force, denoting repulsion, is represented by a line measured *away* from A, whilst the — force, denoting attraction, is represented by line measured *towards* B.

The + 10 units placed at C are therefore acted on by these two forces; it is required to find the magnitude and direction of their resultant, *i.e.*, a single force which would have the same effect as the two given forces combined.

This can be done by the aid of a proposition called the *parallelogram of forces*, viz., *If two forces be represented in magnitude and direction by two straight lines proceeding from the point where the forces act, the resultant force will be represented in magnitude and direction by the diagonal, drawn from the point where the forces act, of the parallelogram of which the above two lines form adjacent sides.*

To find, then, the resultant of the forces represented by CD and CE, complete the parallelogram CDFE, and draw from C the diagonal CF. Then CF represents in magnitude and direction the resultant force required.

To calculate the numerical value of this force in dynes, remember CD = 1, CE = DF = 1, and the three sides CD, DF, and FC of the triangle CDF can be seen by simple geometrical reasoning to be parallel to AC, CB, and BA respectively. Therefore the triangle CDF is equilateral, and CF = CD = 1. Therefore the resultant force = 1 dyne acting in the direction CF.

The student should now work out the problem for the case of — 10 units placed at A, and — 10 at B; also + 10 at A, and + 10 at B. These problems will present no difficulty if the signs of the forces be attended to, and their magnitude and direction be represented according to the above convention.

We are now in a position to find the *field of force* due to two charges of electricity placed at definite points. We have already come to understand the meaning of the electrical field in case of a single charge, and we now adopt the convention of defining the lines of force due to two charges, as curves such that a tangent drawn to one of them at any point will represent the direction of the resultant force at that point.

Let it be required to find the lines of force due to + 10 units at A, and — 10 units at B. Our mode of procedure is to take a point

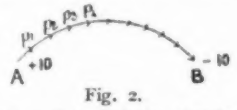

Fig. 2.

p_1, near to A (Fig. 2), and to find the direction of the resultant force precisely as we have done in the above example. Draw a short line p_1p_2 in this direction, and then in a similar manner find the resultant force at p_2. Draw p_2p_3, and proceeding in this way a continuous curve will ultimately be drawn extending from A to B. *This curve represents a line of force.*

(The student is recommended to read chapters I.–III., and to work through the examples to chapter I.)

MATHEMATICS.

STAGES 2 AND 3, SCIENCE AND ART DEPARTMENT.

By G. A. Baxandall,

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With this issue we commence a series of articles dealing with the work necessary for the above-mentioned stages, so it may be well to briefly explain the method to be adopted.

For each part of the subject text-books are recommended, the necessary chapters and articles which the student must read being given each month. Then follow the examples to be worked out, some being selected from the text-books, and the rest from different sources, including past examinations. The answers to these will generally be attached, while hints and solutions of a few will be given the following month.

STAGE 2.

The text-books we shall refer to are—Hamblin Smith's 'Elementary Algebra' (with answers), or Hall and Knight's 'Elementary Algebra;' Hamblin Smith's 'Elementary Trigonometry,' or Lock's 'Elementary Trigonometry'; Todhunter's 'Euclid,' or any other modern edition containing Euclid's first three books. We now append the work for the month.

Algebra.

Read the chapter on Square Root, and the one on Surds.

Work out the following examples :—

Find the square root of

1. $x^4-6x^3+19x^2-30x+25$. Ans. x^2-3x+5.

2. $25x^4y^2-30x^3y^3+29x^2y^4-12xy^5+4y^6$.
Ans. $5x^2y-3xy^2+2y^3$.

3. $4x^2(x^2-y)+y^3(y-2)+y^2(4x^2+1)$.
Ans. $2x^2-y+y^2$.

4. $\frac{4m^2}{n^2}+9\frac{n^2}{m^2}+4-16\frac{m}{n}+24\frac{n}{m}$. Ans. $\frac{2m}{n}-4-\frac{3n}{m}$.

5. $\{(3x+2y)^2+(x-4y)^2\}^2-4(3x+2y)^2(x-4y)^2$.

6. $a^2-2mab+4ac+m^2b^2-4mbc+4c^2$.

7. Reduce as far as possible the quantities under the root sign in $\sqrt{50}$; $\sqrt{720c^2}$; $18\sqrt{\frac{5}{27}x^3}$ and $\sqrt[4]{108m^9n^{10}}$.

Answers. $5\sqrt{2}$; $12c\sqrt{5}$; $6x\sqrt{\frac{5x}{3}}$; $3m^3n^3\sqrt[4]{4n}$.

8. Reduce to complete surds :

$5\sqrt[4]{9}$; $2ax\sqrt{\frac{3a}{4x}}$; $\left(\frac{x-y}{x+y}\right)\left(\frac{x^2+xy}{x^2-2xy+y^2}\right)^{\frac{1}{2}}$.

Answers. $\sqrt[4]{1125}$; $\sqrt{3a^3x}$; $\sqrt{\frac{x}{x+y}}$.

9. Multiply $\sqrt{a-4}-7$ by $\sqrt{a-4}+7$.
Ans. $a-53$.

$\sqrt{x}+\sqrt{y}+\sqrt{z}$ by $\sqrt{x}-\sqrt{y}+\sqrt{z}$.
Ans. $x-y+z+2\sqrt{xz}$.

10. Simplify $\frac{\sqrt{a}}{\sqrt{a}-\sqrt{b}}$; $\frac{2-\sqrt{2}}{2+\sqrt{2}}$; and if $2x-5=\sqrt{13}$, get the value of $\frac{(x-5)(x-1)}{(x-3)}$.

Answers. $\frac{a+\sqrt{ab}}{a-b}$; $3-2\sqrt{2}$; $\frac{\sqrt{13}+7}{6}$.

Trigonometry.

Observe the relation between the circumference of a circle and its diameter, viz. :—

$\frac{\text{circum.}}{\text{diam.}}=\pi=\frac{22}{7}$ or, correct to 5 places, 3·14159.

Read the chapter on the Measurement of Angles, carefully noting the definitions of the circular measure of any angle and of the unit angle, also the magnitude of the unit angle. In particular, remember the circular measure of 180°, and hence of angles which are multiples or sub-multiples of 180°. Learn the definitions of the trigonometrical ratios of any angle.

Work out the following examples :—

1. What is the numerical measure of two right angles in circular measure? If one of the acute angles of a right-angled triangles is 1·2 in circular measure, what is the numerical value of the other angle, (*a*) in circular measure, (*b*) in sexagesimal measure (degrees, minutes, etc.)?
Ans. (*a*) ·371; (*b*) 21° 16′ 21″·8.

2. Define the radian or unit angle in circular measure, and write down in a decimal form, true to five places, the value of the ratio of the circumference of a circle to its diameter. Find, as accurately as you can, the numerical value in circular measure of 45° and of 25° 10′.
Answers. (1) 3·14159; (2) ·78539; (3) ·439.

3. What are the numerical values of a right-angle in circular measure and in sexagesimal measure? Find in circular measure the numerical value of an angle of 37° 15′. The radius of a circle being 105 feet, find the length of arc which subtends an angle of 37° 15′ at the centre.
Answers. $\frac{\pi}{2}$; 90°; ·6504; 68·29 ft.

4. What is meant by the circular measure of angles, and what is the unit of circular measures? Given an angle in circular measure, how is its value in sexagesimal measure found? An angle is $\frac{2}{3}$ in circular measure, what is it in degrees, minutes, and seconds. Ans. 38° 10′ 54″·5.

5. ABC is a triangle right-angled at C. If AC = 3 and CB = 4, write down the numerical values of all the trigonometrical ratios for the two acute angles. If CA be produced to D so that the AD = AB, write down the values of the trigonometrical ratios for the angles CDB, CBD.

6. ADCD is a square 12 inches long. A point E is taken between A and B so that BE = one-half EA. If O be the centre of the square, find the values of the sine, secant, and cotangent of the angle AEO. Answers. $\frac{3}{\sqrt{10}}$; $\sqrt{10}$; $\frac{1}{3}$.

Geometry.

Read propositions 1 to 8, Book II.

Try the following riders :—

1. Show that the square on the sum of two straight lines together with the square on their difference is double the squares on the two straight lines.

2. Construct a rectangle equal to the difference of two given squares.

STAGE 3.

For this stage we recommend the following text-books :—Either Todhunter's 'Larger Algebra,' or Hall and Knight's 'Higher Algebra;' although the latter is the better book of the two. For Trigonometry, Todhunter's 'Plane Trigonometry,' Lock's 'Higher Trigonometry,' or Loney's (large book) 'Trigonometry,' will suffice; although the latter is probably the best published. We shall, however, as far as is considered necessary, give instruction in some parts of the work which may not appear in one or the other of the books just mentioned. We shall now append the work for the month.

Algebra.

Read Articles 139–151, and 153, 156, in Hall and Knight; or Articles 487–498 in Todhunter, omitting 496 for the present.

Referring to Hall and Knight, we advise the student to dwell on Article 140, as this principle is of fundamental importance. It is directly applied in establishing many of the formulæ, and one should be always ready to apply it to any example rather than work blindly from the formulæ.

Of the methods in Articles 141 and 143, Hall and Knight, probably the former will appear more satisfactory.

Work out 6, 13, 17, 25, Examples XI.*a*, and 5, 10, 16, 28, Examples XI.*b*, in Hall and Knight; or 8, 9, 12, 26, 29, 36, Examples XXXIV., Todhunter.

Also the following :—

1. Twenty different letters are to be distributed among 4 persons, giving five to each; in how many ways can this be done? Ans. $\frac{\lfloor 20}{\{\lfloor 5\}^4}$.

2. At a game of cards, three being dealt to each person, any one can have 425 times as many hands as there are cards in the pack; find number of cards. Ans. 52.

3. Out of 20 men who have to sit down, half on each side of a long table, 4 men desire to sit on one side, and 6 others to sit on the other side; find the number of ways in which this can be done. Ans. $\frac{\{\lfloor 10\}^3}{\lfloor 4 \lfloor 6}$.

4. There are 7 exactly similar groups of 11 things (*a*, *b*, *c*, etc.). In how many ways can 7 things be taken one out of each group, consistently with one particular thing (*e.g.*, *a*) being taken twice, neither more nor less? What would the result be if there were *m* groups of *n* things each, and one particular thing were taken *p* times?

Example.—There are 4 regular polyhedrons marked, each with a different symbol, the numbers of their faces being 4, 6, 8, 12, re-

spectively; taking all of them together, how many different throws are possible?

Solution.—Consider the first polyhedron; the operation of throwing it can be performed in 4 different ways, for any one of the faces may turn up. When this operation has been performed in any one way, there are 6 ways of performing the operation of throwing the second polyhedron; hence according to the principle referred to above, there are $4 \times 6 = 24$ ways of performing the operation of throwing 2 polyhedrons; and, therefore, by an extension of this reasoning, the total number of throws $= 4 \times 6 \times 8 \times 12 = 2304$.

Example.—Three persons have 4 coats, 5 vests, and 6 hats between them; in how many different ways can they dress themselves with them?

Solution.—Consider any one man; he may select a coat in 4 ways, a vest in 5 ways, and a hat in 6 ways; and, therefore, by the fundamental principle, he can dress himself in $4 \times 5 \times 6 = 120$ ways. Now when he has dressed himself in any one of these ways, a second man can choose a coat in 3 ways only, a vest in 4 ways, and a hat in 5 ways; that is, he may dress himself in $3 \times 4 \times 5 = 60$ ways. Again, therefore, by the principle, two men may dress themselves in $120 \times 60 = 7200$ ways, and when they have done so in any one of theseways, the third man can dress himself in $2 \times 3 \times 4 = 24$ ways; and, therefore, the required result is $120 \times 60 \times 24 = 172800$ ways.

Trigonometry.

Read from any of the text-books the articles which deal with the area of a triangle (three formulæ) and the radii of the circles inscribed in or circumscribed about a given triangle.

Work out the following examples, in which the letters have the usual meanings, viz., R, r r_a r_b r_c, for the radii of the circumscribed, inscribed, and escribed circles respectively, S being the area of triangle.

Prove that:—

1. $2Rr = \dfrac{abc}{a+b+c}$.
2. $16R^2 r r_a r_b r_c = a^2 b^2 c^2$.
3. $rr_a = S$, where a is one side of a triangle right-angled at C.
4. $r_a r_b r_c = abc \cos\frac{A}{2} \cos\frac{B}{2} \cos\frac{C}{2}$.
5. $4S = (a+b+c)^2 \tan\frac{A}{2} \tan\frac{B}{2} \tan\frac{C}{2}$.

The lengths of the tangents from a corner of the triangle to inscribed or escribed circle are useful, and may be found as follows:—

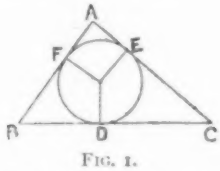


FIG. 1.

The six tangents = perimeter = $2s$; ∴ three different tangents,

$$AE + CD + BD = s;$$
$$\therefore AE + a = s;$$
$$\therefore AE = s - a.$$

FIG. 2.

$$CD = CE,$$
$$BD = BF;$$
$$\therefore AB + BD + AC + CD = AF + AE = 2AE;$$
$$\therefore 2s = 2AE,$$
$$s = AE.$$

Euclid.

In the Third Stage a thorough knowledge of the first three books of Euclid is required, a couple of riders being generally set on them. We can, therefore, only ask the reader to work out as many riders as his time permits of. A few riders will be given each month, and their solutions will appear in the following issue.

Try the following riders:—

1. If two equal circles are given intersecting in A and B, and if any straight line be drawn through either of these points to meet the circles in C and D; find the locus of the middle point of CD.
2. C is the point of contact of two circles which touch each other internally, and CPQ is a straight line, cutting the inner circle at P and the outer circle at Q; the tangent to the inner circle at P cuts the outer circle at A and B; show that the arc AQB is bisected at Q.

BIG TELESCOPES AND THEIR USE.

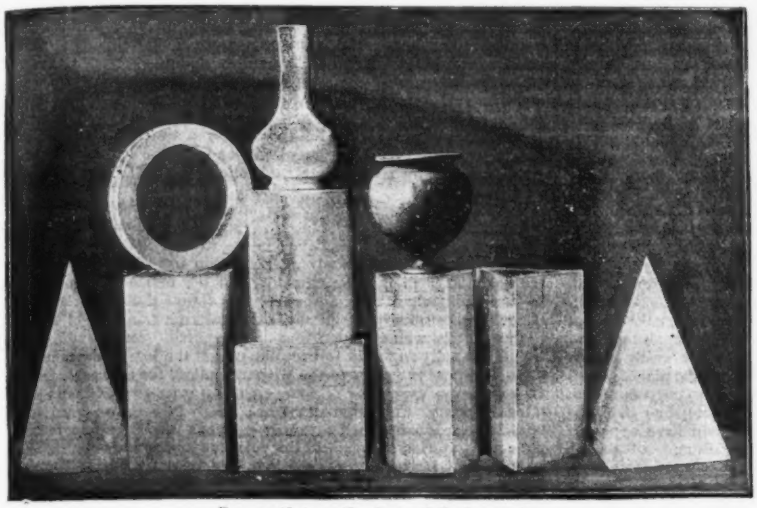
BY RICHARD A. GREGORY, F.R.A.S.

Oxford University Extension Lecturer. Author of 'Elementary Physiography,' etc.

BY looking through two spectacle lenses held a short distance apart, objects can be made to appear nearer. The story goes that a child's exclamation of wonder at the appearance of a church spire, when viewed under these conditions, attracted the attention of a spectacle-maker in Holland about 1688, who afterwards utilised the principle in the construction of the first telescope. The instrument, like that used by Galileo, had an arrangement of lenses precisely similar to those in a sixpenny telescope or a common opera-glass, and, compared with the means now at the disposal of astronomers, was a very feeble affair. However, such optical aid enabled Galileo to see spots on the sun, to discover four moons revolving round the planet Jupiter, and to observe that Venus changes from half to full and so on, just like our moon. A new kind of astronomy was thus founded. Before the invention of the telescope, the positions and motions of the heavenly bodies were the subjects of study; after, it became possible to inquire what the objects are in themselves.

Although a modern astronomical telescope, with its numerous and complicated accessories, differs very considerably in appearance from the simple instrument used by Galileo in his scrutiny of celestial objects, the optical principles underlying the two are much the same. Both consist essentially of a large lens (termed the objective) to form an image of the object under examination, and a small lens, or combination of lenses (known as the eye-piece) to magnify the image. If the functions of these glasses are properly understood, the power of an astronomical telescope to see faint objects and to magnify them can always be estimated. Consider first the use of the objective. Rays of light, which produce in us the sensation of sight, can only enter our eyes through the pupil. Increase the size of the pupil, and the amount of light received is increased in the same proportion. This can easily be proved by noticing the size of the pupils of a cat's eyes at different times. During the bright light of day, the iris will be seen to contract and so diminish the size of the pupil. As the light fades, however, the pupil increases in size so as to grasp as many rays as possible. Now, the average diameter of the pupil of the human eye is one-fifth of an inch. With a pupil as big as a halfpenny, twenty-five times more light would be collected than under ordinary circumstances. In the same way, the brightness of an object observed in a telescope depends upon the surface of the objective. A lens ten inches in diameter shows a star 2,500 times brighter than if seen with the naked eye, and one 36 inches in diameter collects 32,000 times more light than an eye would perceive, and concentrates it into a luminous image. The part played by the objective, then, is to increase the apparent brightness of the objects observed. On this account, it is possible to see the brighter stars in the day-time, with a telescope of moderate dimensions; for though the few rays of light that enter the pupil of the eye from such stars are insufficient to excite the visual sense, the large number of rays collected by the lens, and concentrated into a beam small enough to enter the pupil, is sufficient to do so. The larger the lens, the larger is the amount of light collected by it. In fact, the power of a telescope—taking this expression to mean the ability of the instrument to reveal faint objects—is measured by the diameter of the objective. The cry of the astronomer is 'More Light,' and optical glass manufacturers have been taxed to the utmost to satisfy his cravings.

But, it will be asked, what about the ability of the telescope to magnify the heavenly bodies, to bring the denizens of space apparently nearer to us? This power is obtained by means of the combination of lenses at the eye end of the telescope, and can be varied



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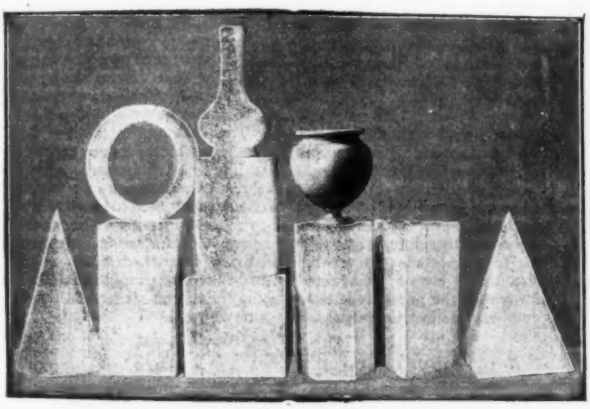

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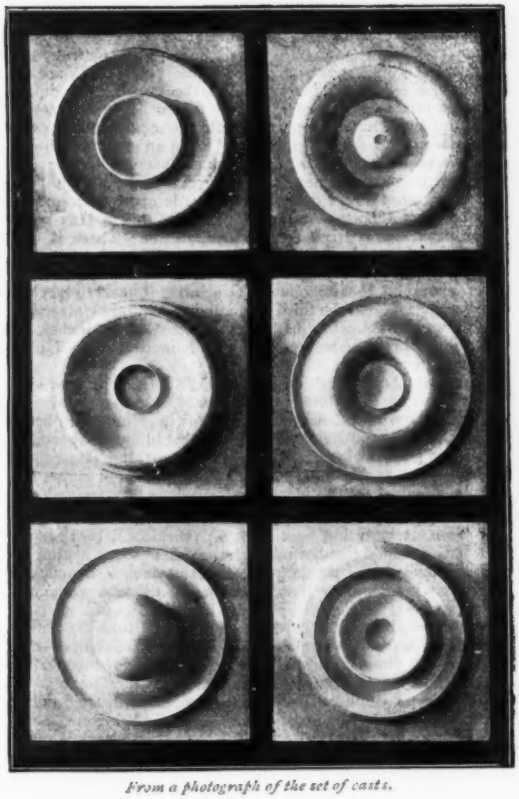

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at will. A telescope of any pretensions has a stock of such lenses belonging to it, capable of magnifying from 50 to about 1,000 times. For many observations in astronomy, a high magnifying power is undesirable, and in some cases useless. This comes as a shock to the ideas of most visitors to observatories. They expect to see stars appear at least as big as saucers, and can hardly realise that it is impossible to magnify these distant bodies. A star is never seen otherwise than as a point of light, when viewed under proper conditions. It is more or less brilliant according to the size of the telescope, but possesses no particular features. The number of stars, however, that can be seen by telescopic aid is enormous. To the naked eye, on a very fine night, about 2,500 stars are visible. By using a common opera-glass, this number is increased to 100,000, and a telescope two-and-a-half inches in diameter will show three times as many. But, though it is impossible to magnify the stars, yet the sun, moon, and planets—objects much nearer to us—can have their apparent size increased. An instrument of moderate dimensions will show the moon as it would be seen by the naked eye at a distance of about 500 miles, and any streak or wall upon the lunar surface a quarter of a mile or so long can then be easily distinguished. During the opposition of Mars this year, the planet passed the earth on October 12 at a distance of about 40,000,000 miles. If it had been possible to use a power magnifying one thousand times when observing our ruddy brother, he would have appeared one thousand times nearer to us, that is, at a distance of 40,000 miles. But according to reports received up to now, this high magnification was not achieved, for in no telescope could Mars be apparently brought nearer than about 70,000 miles.

The largest telescope in the world in which a glass lens is used to condense the beams of light is at the Lick Observatory, Mount Hamilton, California. The diameter of the objective is 36 inches, and the length of the telescope 60 feet. This telescope will show a hundred million stars to an ordinary observer—that is, a star each for every English-speaking person in the world. The image of the moon produced by the large lens is five inches in diameter; and by letting it fall upon a prepared plate, some marvellous photographs of our satellite have been taken. From an examination of the best of these pictures, it has been found that parallel walls on the moon, whose tops are not more than 200 yards or so in width, and which are not more than 1,000 or 1,200 yards apart, are plainly visible. The second largest refracting telescope has a lens 30 inches in diameter. It is erected at Pulkova, Russia. There is one slightly smaller than this at Nice. The next in size is the Vienna telescope, diameter 27 inches. After these come three instruments of about 26 inches, one at Greenwich Observatory, another in Washington, and the third belonging to Virginia University. Then follows the refractor, having a diameter of 25 inches, presented two or three years ago by Mr. Newall to the University of Cambridge.

It is doubtful whether telescopes with glass objectives will be made much larger than those now in use. Considerable difficulties are experienced in the manufacture of the discs of clear glass required for the lenses. After several years spent in unsuccessful attempts, a firm of glass makers has managed to cast the disc required for a lens of 40 inches diameter, but some time must elapse before the telescope for which it is intended will be in working order.

Besides the familiar form of telescope, there is another kind known as reflecting telescopes, or reflectors. In this, a concave mirror, shaped like the mirror sometimes placed behind gaslights, takes the place of the large lens. And since it is much easier to make a large mirror than to cast a disc of glass without blemish, we find that the largest telescopes in the world are reflectors. The renowned instrument erected for Lord Rosse at Parsonstown, Ireland, is of the same length as the Lick telescope—sixty feet—and has a diameter of six feet, so that the tube could be walked through by a tall man without the necessity of stooping. The next in size is a magnificent five-foot instrument constructed and possessed by Mr. A. A. Common, of Ealing. Sir William Herschel built a reflector four feet in diameter a little more than a century ago; another of the same size was erected by Mr. Lassell in 1860, and one at Melbourne in 1870.

So much has recently been written about communicating with the moon and some of the planets, that a remark made by Mr. Lassell concerning the efficiency of his telescope should be interesting. He claimed that if the lunarians were shaking a carpet as large as Lincoln's Inn Fields, he could see whether it was round or square. As Professor Norman Lockyer has said, 'This would be the *ne plus ultra* in the case of a body at the distance of the moon, viz. 240,000 miles.'

There are in England several reflecting telescopes about three feet in diameter—that is, of the same size as the Lick Observatory refractor. Mr. Common has one at Ealing, in addition to his five-foot instrument, and Professor Lockyer has another of excellent quality at South Kensington.

It is well known that the heavenly bodies are constantly in motion across the sky; hence, to observe them telescopically, it is necessary that the instrument should be made to move at the same rate. This desideratum is realised in all telescopes of importance. An astronomer first points his telescope to the object he wishes to observe, and then connects it with a clockwork arrangement which will drive it at the same rate as the stars. Should the sky afterwards cloud over, the telescope can be left to itself for a time, but when it is clear again the astronomer goes back, and is able to continue his work without any readjustments, for the object will still be in the field of vision.

In this connection a few words on the way in which stars are photographed may not be out of place. When a photographer is taking a portrait he generally says, before taking the cap off the lens, 'Keep still, please.' But the heavenly bodies do not obey the will of the astronomer in their movements, and the difficulty is got over by the driving-clock making the telescope follow the stars. Another difficulty in celestial photography is the extreme faintness of many of the objects whose impressions are required. In taking a portrait it is usually sufficient to keep the cap off the lens of the camera, so as to expose the sitter to the prepared plate, for about a second. In astronomy, exposures of four, eight, or even twenty hours are often necessary. The operations are briefly as follows: First, the telescope is adjusted in its proper position, and a photographic plate is inserted in the place of the defective human eye—for, viewed as an optical instrument, the eye is full of imperfections. The astronomer can then sit down and indulge in a contemplative pipe as long as he likes. His telescope will do the work. The clock keeps the instrument directed towards the required region of the sky, and that region is leaving its imprint upon the photographic plate. If an exposure lasting throughout the night is not long enough, the slide of the camera is shut up at daylight, and opened again when the telescope has been given its proper direction on the following evening. As an example of the kind of assistance given by photography to astronomy, it may be remarked that 16,000 stars have been photographed in an area of the sky in which only 94 stars could be seen with a 3-inch telescope, and less than half-a-dozen could be distinguished with the naked eye. The reasons for this are that the photographic plate is sensitive to rays which produce no visual effect; and that it can accumulate luminous impressions which in the case of the human retina fade entirely away every tenth of a second. Hence it is possible to photograph objects so faint as to be altogether beyond the power of any telescope to reveal to any observer. In this direction, therefore, will the astronomy of the future be developed, for telescopes may almost be said to have reached their greatest size. And even if this were not so, the photographic plate does away with the necessity of constructing larger and consequently more cumbersome instruments than those now in use.

SOLUTIONS TO QUESTIONS IN THEORETICAL MECHANICS.

BY F. CASTLE, M.I.M.E.

(*Continued from p.* 14, *October Supplement.*)

10. (*a*) State the meaning of the formula $v^2 = V^2 + 2fs$, and of each letter in it.

(final velocity)^2 = (initial velocity)^2 + 2 (acceleration × space).

In the given formula v represents final velocity in feet per second.

V represents initial velocity in feet per second.

f represents the acceleration of the particle in feet per sec., per sec.

s represents the space (in feet) described since the body had a velocity V.

In the formula the acceleration is assumed to be uniform.

(*b*) If a particle, whose mass is 15 lbs., moves along a straight line under the action of a force of 40 poundals, what will be the numerical value of f, and in what units is it expressed?

Using the formula $F = Mf$ (where F = force in poundals, M = mass in lbs., f = acceleration).

$$f = \tfrac{40}{15} = 2\tfrac{2}{3} \text{ feet per sec., per sec.}$$

(*c*) If that particle describes a distance of $33\frac{1}{3}$ ft., and has a velocity of 4 ft. a second at the beginning of the distance, what velocity will it have at the end?

From the above formula

$$v^2 = 4^2 + 2 \times \tfrac{8}{3} \times 33\tfrac{1}{3}$$
$$= 16 + 180 = 196;$$
$$\therefore v = 14 \text{ ft. per sec.}$$

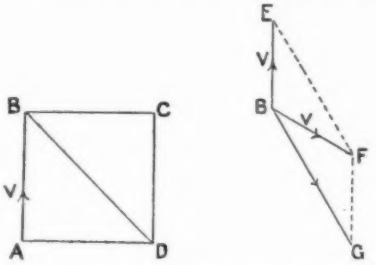
11. (*a*) State the rule for the composition of two velocities.

If a moving point possess simultaneously velocities represented in magnitude and direction by the two sides of a parallelogram drawn from a point, they are equivalent to the velocity represented in magnitude and direction by the diagonal of the parallelogram.

(*b*) Draw a square ABCD, and a diagonal BD; a particle moves along AB with a given velocity; find the velocity that must be impressed on it at B to make it move from B towards D with a velocity equal to that with which it was moving along AB.

Draw the square ABCD and the diagonal BD.

Take any point B^1, and draw B^1E equal to the velocity acting along AB, and parallel to AB. Draw a line B^1F equal to B^1E and parallel to BD; join F to E, and draw B^1G parallel to EF, and FG parallel to B^1E; then B^1G is velocity required.



12. (*a*) A body, whose mass is 10 lbs., is carried up to the top of a house 30 ft. high; by how many foot-poundals has the change of position increased its potential energy?

Increase of potential energy $= 10 \times 32 \times 30 = 9{,}600$ foot-poundals.

(*b*) If it is allowed to fall, what number of foot-poundals of kinetic energy will it have when it reaches the ground? ($g = 32$.)

When the body reaches the ground, the whole of the potential energy will be changed into kinetic energy.

$\therefore$ kinetic energy when body reaches the ground $= 9{,}600$ foot-poundals.

(*c*) If the mass of a particle is 24 lbs., and its kinetic energy is 75 foot-poundals, what is its velocity?

$\frac{1}{2} \times 24 \times V^2 = 75$, where V = velocity of body;

$\therefore V^2 = \frac{75}{12} = \frac{25}{4}$;

$\therefore V = 2\frac{1}{2}$ ft. per sec.

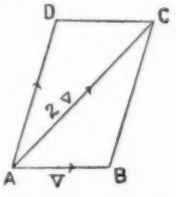
(*d*) Define a foot-poundal.

A foot-poundal is the work done by a force of one poundal (about half an ounce) acting through a distance of one foot, the distance being measured in the direction in which the force acts.

SOLIDS.—Advanced Stage.

21. (*a*) State the rule for the composition of two velocities.

See answer to Question 11, Elementary Stage.



(*b*) Draw two lines AB, AC, containing an acute angle; a particle is at A, moving with a given velocity V from A towards B; give a construction for determining the velocity that must be impressed on it to make it move with a velocity 2V from A towards C.

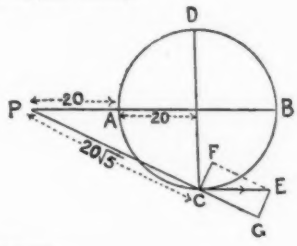
Make $AC = 2AB = 2V$, join CB, and draw through A a line AD parallel to CB, and through C draw a line CD parallel to AB, then AD represents the magnitude and direction of the velocity required.

22. (*a*) Draw a circle with centre O, and two diameters AB, CD, at right angles to each other, and let the direction A, C, B, be contrary to that of the motion of the hands of a watch; produce OA to P, making AP equal to OA; let the radius of the circle be 20 ft.; suppose a particle to move along the circumference of the circle in the direction A, C, B, at the rate of 12 ft. a second; find its angular velocity with respect to O.

Let v = velocity of particle in ft. per sec.

,, r = radius of circle in ft.

,, w = angular velocity.



From $v = wr$.

$\therefore 12 = w \times 20$.

$\therefore w = \frac{12}{20} = \frac{3}{5}$.

(*b*) Find also its angular velocity with respect to P, (1) when it is at A, (2) when it is at C, (3) when it is at B.

(1) $w = -\frac{12}{20} = -\frac{3}{5}$.

(2) For the point C, resolve the given velocity along the radius (PC) and perpendicular to it (the component CG will give no angular velocity). Divide velocity along CF by the radius PC, and we then obtain the angular velocity about P required, thus—

Velocity along CF = CE cos FCE.

$= CE \sin CPO.$

$= 12 \times \frac{20}{20\sqrt{5}} = \frac{12}{\sqrt{5}}$

$\therefore$ angular velocity when at C $= \frac{12}{\sqrt{5} \times 20\sqrt{5}}$

$= \frac{3}{25}$.

(3) Angular velocity when at B $= \frac{12}{60} = \frac{3}{15}$.

23. (*a*) State Newton's Three Laws of Motion.

First Law: Every body continues in a state of rest or of uniform motion in a straight line, except in so far as it may be compelled to change that state by force acting on it.

Second Law: Change of motion is proportional to the acting force, and takes place in the direction of the straight line in which the force acts.

Third Law: To every action there is always an equal and contrary reaction; or the mutual actions of any two bodies are always equal and oppositely directed in the same straight line.

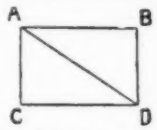
(*b*) Give his illustrations of the Third Law of Motion.

(1) If any one presses a stone with his finger, his finger is also pressed by the stone.

(2) If a horse draws a stone fastened to a rope, the horse is drawn backwards, so to speak, equally towards the stone.

(3) If one body impinges on another and changes the motion of the other body, its own motion experiences an equal change in the opposite direction.

(*c*) Give Newton's Proof of the Parallelogram of Forces.



Suppose that a force M, impressed separately on a body when at the point A, would cause it to move in a given time from A to B with a uniform velocity; and suppose that a force N, impressed separately on the same body when at the point A, would cause it to move in the same time from A to C with a uniform velocity. Let the parallelogram ABDC be completed. Then, if the forces are supposed to be impressed simultaneously, the body will move in the same time with a uniform velocity from A to D. For since the force N acts along AC parallel to BD, this force by the second law will not change the velocity of approach to BD, generated by the other force. Therefore the body approaches the line BD in the same time, whether the force N be impressed or not; and at the end of the given time it will be found somewhere in BD. In the same way it can

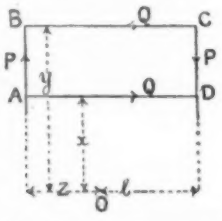
be proved that at the end of the same time it will be found somewhere in the line CD; and therefore it must be found at their point of intersection D. But by the first law it will proceed by a rectilinear motion from A to D.

Now bearing in mind that forces impressed instantaneously on equal masses are proportional to the velocities they generate, it follows that the forces M, N, and their resultant are proportional to the lines AB, AC, and AD.

24. (*a*) Define a couple.

A couple consists of two equal unlike parallel forces, not in the same line of action.

(*b*) Let A, B, C, D be the angular points of a rectangle taken in order; let equal forces (P) act from A to B and C to D respectively; also let equal forces (Q) act from A to D and C to B respectively; without assuming any property of couples, show that when the four forces are in equilibrium P : Q :: AB : AD.



Take any point O, in the plane containing the forces, and draw perpendiculars from O to the lines of action of the forces. Let the lengths of these perpendiculars be x, y, z, and l, as shown in diagram.

Then for equilibrium we have $-Qx + Qy - Pz - Pl = 0$;

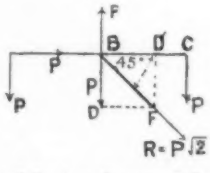
$$\text{or } Q(y-x) = P(z+l).$$

But $y - x = AB$ and $z + l = AD$;

$$\therefore Q \times AB = P \times AD;$$

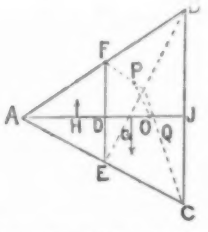
$$\text{or } P : Q :: AB : AD.$$

(*c*) Let A, B, C be three points in a straight line, B being midway between A and C; let three equal forces (P) act at A, B, C respectively at right angles to AC, viz., those at A and C in one direction, that at B in the opposite direction; let a fourth force, equal to P, act from A to C; find, in any way, the resultant of the four forces, and give the specification of the resultant when you have found it. (25)



The resultant of the two downward forces each equal to P, acting at A and C, is 2P acting at B; hence at B we have 2P acting along BD; also in the same line P upwards and P horizontal; hence making BD′ = BD = P the resultant is represented in direction and magnitude by the line BF, where BF = P√2, at an angle of 45° to AC as shown.

25. ABC is a triangle, and E, F the middle points of CA and AB; join EF; a particle, whose mass is 10, is placed at B; find the masses of the particles that must be placed at C, E, F if the centre of gravity of the four is to coincide with that of the area BCEF. (20)



The centre of gravity of the area BCEF can be obtained by construction as follows:—Bisect the base BC at J; join EB and AJ; bisect EB at K; the centre of gravity of triangle BFE is at P, where KP = ⅓KF. Similarly Q is taken so that KQ = ⅓KC; join PQ; the intersection of line PQ with AJ at O gives the centre of gravity of area BCEF. Or, take JG = ⅓JA, then G is centre of gravity of triangle ABC.

Similarly DH = ⅓DA gives H the centre of gravity of triangle AFE.

Triangle AFE is similar to triangle ABC, and AF = ½AB.

∴ area of triangle AFE = ¼ area of triangle ABC; also AH = HG = GJ.

Let AJ = x and GO = y. Taking moments about O we have ¾ (HG + GO) = 1 × GO.

$$\therefore \tfrac{3}{4}(\tfrac{1}{3}x + y) = y.$$

$$\therefore \tfrac{3}{4}y = \tfrac{1}{12}x, \text{ or, } y = \tfrac{1}{9}x.$$

If the mass acting at C = 10, resultant of 10 at B and 10 at C = 20 at J.

If the masses at F and E be each equal to m, the resultant will be $2m$ at D.

$$\therefore 2m \times DO = 20 \times OJ.$$

$$\therefore 2m \times \left(\frac{x}{2} - \frac{2}{9}x\right) = 20\left(\frac{x}{3} - \frac{x}{9}\right).$$

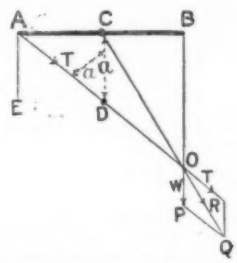
$$\therefore 2m \times \tfrac{5}{18}x = 20 \times \tfrac{2}{9}x.$$

$$\therefore m = 8.$$

Hence the masses are 10 at C, and 8 at E and F.

26. (*a*) AB is a rod without weight that can turn freely round a fixed point C, midway between A and B; a string is fastened to A and to a fixed point D, at a given distance vertically below C; a given weight is hung from B; the length of the string is such that AB is horizontal; find the tension of the string, and the magnitude and direction of the pressure on the fixed point C.

Let the given distance CD = a, W = the given weight, α = angle CDA = inclination of string to the vertical, and T = tension in the string AD.



Draw AE perpendicular to AB, then component of T in line AE multiplied by length AC must equal W × BC.

$$\therefore T \times \cos\alpha \times AC = W \times CB; \text{ but } AC = CB;$$

$$\therefore T \cos\alpha = W.$$

Produce AD and line of action of W to meet at O; join OC; then OC is the direction of the reaction at fixed point C, and CO is direction of pressure on C.

Complete the parallelogram at point O, then OQ = R = resultant, or, ∴ pressure on C. The length OQ can be measured, or,

$$\begin{aligned} R &= W^2 + T^2 - 2WT\cos OPQ \\ &= W^2 + T^2 + 2WT\cos\alpha \\ &= 3W^2 + T^2. \end{aligned}$$

(*b*) If the rod were simply placed on a smooth fixed point at C, would it stay at rest? And if not, why not? (25)

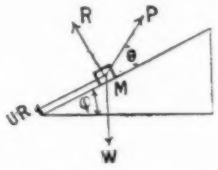
If C was a smooth fixed point the rod would not stay at rest, because the smooth point could offer no resistance to the revolved part of T along the rod, which would therefore cause the rod to slide in a direction AB.

27. (*a*) A particle of given weight is placed on a rough inclined plane; find the relation between the power and the weight, when the power is on the point of making the particle slide up the plane.

Let the particle M of given weight W be acted on by the force P, making an angle θ, with the plane.

Let μ denote the coefficient of friction; R the normal reaction of the plane.

Revolving along the plane we have $W \sin \phi + \mu R = P \cos \theta$. (1)



Revolving perpendicular along the plane we have $R - W \cos \phi = -P \sin \theta$. (2)

Eliminating R, $\therefore W(\sin \phi + \mu \cos \phi) = P(\cos \theta + \mu \sin \theta)$.

$$\therefore \frac{P}{W} = \frac{\sin \phi + \mu \cos \phi}{\cos \theta + \mu \sin \theta}.$$

(*b*) A particle will just stay at rest on a plane inclined at an angle of 30° to the horizon; if the angle of the plane is reduced to 15°, compare the force acting parallel to the plane that will just make the particle slide down the plane, with the force acting parallel to the plane that will just make the particle slide up the plane. (25)

If angle of repose be 30°, then $\mu = \tan 30° = \frac{1}{\sqrt{3}}$.

Also, since P acts parallel to the plane $\theta = 0°$, $\therefore \cos \theta = 1$, $\sin \theta = 0$.

Hence force required to make the particle slide up is $P = W(\mu \cos \phi + \sin \phi)$.

Hence force required to make the particle slide down is $P' = W(\mu \cos \phi - \sin \phi)$.

$$\therefore \frac{P'}{P} = \frac{\mu \cos \phi - \sin \phi}{\mu \cos \phi + \sin \phi}.$$

$$\sin 15° = \frac{\sqrt{3} - 1}{2\sqrt{2}}.$$

$$\cos 15° = \frac{\sqrt{3} + 1}{2\sqrt{2}}.$$

$$\therefore \frac{P'}{P} = \frac{\frac{1}{\sqrt{3}} \times \frac{\sqrt{3}+1}{2\sqrt{2}} - \frac{\sqrt{3}-1}{2\sqrt{2}}}{\frac{1}{\sqrt{3}} \times \frac{\sqrt{3}+1}{2\sqrt{2}} + \frac{\sqrt{3}-1}{2\sqrt{2}}}.$$

$$= \frac{\sqrt{3}+1-3+\sqrt{3}}{\sqrt{3}+1+3-\sqrt{3}} = \frac{\sqrt{3}-1}{2} = \frac{.732\ldots}{2}.$$

28. (*a*) Define a poundal.

When a pound, a foot, and a second are respectively the units of mass, length, and time, the corresponding unit of force is called a poundal, and this force acting on unit mass produces unit momentum in one second.

(*b*) It is known that the acceleration due to the attraction of a planet on a body near its surface varies nearly as the mass of the planet directly, and the square of its radius inversely. It is found that the mass of Jupiter is about 370 times that of the earth, and that his radius is about 11 times that of the earth. With these data, and assuming that the acceleration due to gravity near the earth's surface is 32 in feet and seconds, find the force in poundals of Jupiter's attraction on a pound of matter near his surface. (25)

Acceleration near the surface of Jupiter

$$= \frac{370}{1} \times \frac{1}{121} \times 32$$

$$= 97{\cdot}85.$$

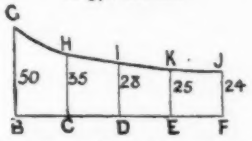
Hence the attraction on 1 lb. of matter near the surface of Jupiter = 97·85 poundals nearly.

29. (*a*) Draw a line A*x*, and take in it five equidistant points B, C, D, E, F; suppose a force (P) to act along A*x*, and that its values at the points B, C, D, E, F are respectively 50, 35, 28, 25, 24 lbs.; let the distances BC, CD, . . . represent 3 ft. a piece; draw a diagram of the work done by the force, and calculate (by Simpson's Rule, if you know it) in foot-pounds the work done by the force while acting from B to F.

Diagram of work done by the force is represented by the area HIJG, *Simpson's Rule.* Add together the first and last ordinates, twice the sum of all the other odd ordinates, and four times the sum of all the even ordinates, and multiply the result by one-third of the common distance between two adjacent ordinates.

$\therefore$ Work done $= \{50 + 24 + 2(28) + 4(35 + 25)\} \times \frac{1}{3} \times 3$

$= 370$ foot lbs.



(*b*) Find also what the result would have been, if no more than the values of P at B, D, F had been given. (25)

If only the values at B, D, F were given,

Work done $= \{50 + 24 + 4 \times 28\} \times \frac{1}{3} \times 3$

$= 186$ foot lbs.

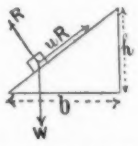
Note.—When Simpson's Rule is used care should be taken that the number of ordinates is odd (viz., 5, 7, 9, &c.), and the distances between them are equal.

In (*b*) instead of using Simpson's Rule the result would be better as follows:—

$$\text{Work done} = \frac{50+28}{2} \times 6 + \frac{28+24}{2} \times 6$$

$$= 78 \times 3 + 52 \times 3 = \underline{390 \text{ ft. lbs.}}$$

30. (*a*) A particle slides down a rough inclined plane; find the acceleration of its velocity.



Let *l*, *h*, and *b* denote the length, height, and base of the plane respectively, then force causing acceleration

$$= \frac{Wh}{l} - \frac{uWb}{l}$$

$$= \frac{W}{l}\left(h - ub\right)$$

But force = Mass × acceleration, or F = M*f*.

$$\therefore f = \frac{F}{M} = \frac{W}{l}\left(\frac{h - ub}{W}\right) \times g$$

$$= \frac{h - ub}{l} \times g \text{ ft. per sec. per sec.}$$

(*b*) The angle of inclination of the plane is 30°; and the coefficient of friction is 0·5; if one body falls freely through a given distance, and another body slides down the plane along an equal distance, show that the time of the first body's motion will very nearly equal one fourth part of the time of the second body's motion. ($\sqrt{3} = 1{\cdot}73205$.) (20)

When the particle falls freely $t = \sqrt{\frac{2s}{g}}$

,, ,, moves along incline, $t' = \sqrt{\frac{2s}{f}}$

$$\therefore \frac{t}{t'} = \frac{\sqrt{\frac{2s}{g}}}{\sqrt{\frac{2s}{f}}} = \frac{\sqrt{f}}{\sqrt{g}}$$

$$= \frac{\sqrt{(h - ub)g}}{\sqrt{l} \times \sqrt{g}} = \frac{\sqrt{\left(1 - \frac{\sqrt{3}}{2}\right)}}{\sqrt{2}} = \frac{\sqrt{(2 - \sqrt{3}}}{2}$$

$$= \frac{\sqrt{.20795}}{2} = \frac{1}{4} \text{ nearly.}$$

31. (*a*) A body is tied to a string and is whirled round in a vertical circle; find the least velocity it can have at the lowest point, if it is to describe the whole circle.

When the body is in the lowest position it must have sufficient kinetic energy to carry it to a height equal to twice the radius of the circle.

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WELL-KNOWN TEACHERS AT WORK.

XXXIV.—MR. JOHN W. TATE,

Head Master Beethoven Street (Higher Standard) School, Queen's Park, N.W.

FROM no less an authority than that fount of proverbial wisdom, Martin Tupper, we have it that 'the many-sided mind is ripe for every prize.' We opine that Mr. Tate must subscribe very liberally to this doctrine, for he has ever been on the alert to make his children many-sided, and to give them such a complete mental equipment and endowment as shall ensure for them at least a fair proportion of the prizes resulting from a stout and man-like quittance in the stern race of life. Pope's cautious advice contained in the well-known couplet—

> Be not the first by whom the new is tried,
> Nor yet the last to lay the old aside—

would certainly not commend itself to Beethoven Street, for in many things, notably in regard to manual training and liberty of classification, Mr. Tate has taken time by the forelock and managed to be commendably 'previous' in laying aside old tradition and in creating and promulgating a new doctrine. A misquotation of Cowper (for which may his manes pardon us) will give a just conception of Mr. Tate's attitude towards hand-work—

> Here the *hand*
> May give a useful lesson to the head,
> And Learning wiser grow without his books.

In the *Contemporary Review* of Nov. 1886, Sir Philip Magnus bore just testimony to the pioneering work of the Beethoven Street Head Master. 'In London the experiment has recently been tried on a small scale, and under not the most favourable circumstances, in the Beethoven Street Schools; but the report of Mr. Tate, the energetic Head Master, is so encouraging that the School Board for London is very desirous of extending the system of instruction to a large number of the schools under its control. In his report to the Board, Mr. Tate says:—"This class was started on Sept. 26th, 1885, in a shed or workshop built by the Board in a recess in the playground, and the instruction is given by the school-keeper, a carpenter by trade, under the direct supervision of the Head Master."' Thus far the Mr. Tate of 1885. That he has in no whit receded from this position the enthusiastic work that we saw in progress in the 'shed,' no less than the public exhibition of the Board, as well as the many useful articles of school furniture—'the work of our own hands'—to be met with in every room of Beethoven Street School, incontestably prove.

The school is a mixed one, and this system, so popular in Scotland and the North of England, has no abler or more enthusiastic advocate than the subject of our present sketch, as the following testimony will prove:—

LONDON SCHOOL BOARD.—SPECIAL COMMITTEE ON THE SUBJECTS AND MODES OF INSTRUCTION IN THE BOARD'S SCHOOLS. JUNE, 1887.

Statement of Mr. Tate, Head Master of the Beethoven Street, Queen's Park Estate, School.

Mr. Tate attended before the Committee, and in answer to questions replied to the following effect:—

I have been an elementary teacher since 1865. Before I came to the Board I was Head Master of a Boys' School at Brentford with an average attendance of 300. My little experience of girls was gained during the temporary absence of my wife through illness, and I took charge of her school, with an average attendance of 200, in addition to my own, for six months. My wife and I always taught our pupil teachers and candidates together, about sixteen in all, as a mixed class. I came under the Board in 1881, when I was appointed Head Master of the Mixed Department of the Beethoven Street School, which has an average attendance of about 700. I was the first Head Master of this school. It was entirely left to me to organize the school as I chose. At first I intended to mix the classes. The first year I only had one class mixed, and that seemed to answer well. The next year I had three or four, and the third year all the classes were mixed. My experience at Beethoven Street convinces me that a mixed school is decidedly superior to a school organized in two departments. One great advantage of a mixed school, I notice, is in the behaviour of the children—the tone we can get. This is apparent with the older as well as the younger children. The only time there has been any trouble of boys taking any notice of girls was within the first three or four months from the opening of the school. As soon as the discipline of the school began to tell, I noticed nothing whatever of an objectionable nature.

The children attending the Beethoven Street School are of all sorts, some being the children of the higher artisan class and some of unskilled labourers. Two of my managers send their children to the school, and one of the Assistant Government Inspectors proposes to send one of his.

I notice from my experience of teaching boys and girls together that the behaviour of both is improved, and reproof or encouragement has more effect on either sex. For instance, if a girl has a predisposition to bad behaviour she knows she will be reproved. Her natural pride rebels at being reproved before boys, and thus she endeavours to avoid the occasion for it. I think that the presence of girls in the school tends to prevent the use of rough language. I do not receive any complaints from parents, residents, or managers on this question. During the first year over 1,300 children were admitted, and things happened in that year which have not occurred since. Every year I see signs of improvement. The population of the Queen's Park Estate is now more settled, and consists, for the most part, of steady members of the working classes.

Another great advantage of a mixed school is that better results of the instruction are obtained by the boys and girls working with a spirit of emulation. There is a certain sense of shame if the boys are beaten in a competition by the girls. For the last three years, taking the three elementary subjects, the percentage of passes of the girls is slightly in advance of that of the boys. I find that Arithmetic being taught to boys and girls together improves the reasoning power of the girls. By having a large staff, teachers can be put where they can do the best duty. Female teachers are generally put to the lower standards. I find that girls are better at English Composition, and that the boys' Composition is improved just in the same way as the girls' Arithmetic. Girls are more glib with their tongues. The girls, too, improve the boys' Reading. Although good style can rarely be obtained from girls, they have a greater amount of fluency, for which they seem to have a natural aptitude. Moreover, girls add an amount of cheerfulness and vivacity to the class. Another advantage of a mixed school is that there is a freedom from flippant and giddy behaviour in girls. No difficulty is felt by the teachers by the boys and girls being together.

The good tone at Beethoven Street may be due in some degree to the fact that the majority of the children are drawn from the classes where the home influence would naturally be good. My experience of the lower strata of children in the school leads me to believe that it would be an advantage to mix the children in the poorer districts of London. The female teachers are, with one exception, confined to the lower standards. In the more logical portion of the school work I prefer a male teacher. In regard to discipline, a female teacher might take any standard. I do not think there is much in the opinion that a female teacher is better for boys and a male teacher better for girls.

The subjects of instruction taken by the boys and girls vary slightly. The subjects taken by the girls only are Needlework, Cookery, and Swedish exercises, and those taken by the boys only are Geography and Map-drawing, Chemistry, Military Drill, and, in the seventh standard, Manual Instruction. In every other subject they are taught alike. Two years ago the girls were relieved from taking Chemistry, when the Code insisted that a Cookery grant would not be obtained if two specific subjects were taken.

Physical instruction is given to boys in the form of military drill, and one or two teachers give special attention to the gymnastic apparatus. Military drill and manual instruction are taken while the girls are doing Needlework, and Chemistry is partially taught to the boys while the girls are instructed in Swedish exercises. I do not find that the preparation of the time-table is a difficult matter. The only difficulty I have experienced is that it has sometimes to be altered to arrange for the girls to attend Cookery Centres. The lines of instruction in one year follow pretty closely those of the previous year.

The staff at Beethoven Street consists of seven men and five women. The proportion of boys to girls is as four to three. I cannot account for the larger attendance of boys; at the Ashburnham Mixed School, Chelsea, there are more girls than boys. I do not think that the smaller number of girls at Beethoven Street School is due to the parents preferring to send their children to schools where the boys and girls are taught separately. I have only heard of two objections to the school being mixed, and these were made four years ago. I do not think that children often leave the Beethoven Street School to go to other schools in the neighbourhood. Many cases have come under my notice where parents, who have sent their children to this school, leave the district and return to it, when they again send their children to the same school.

The fixed staff at the Beethoven Street School is equal to 750, the accommodation being for 720, and the average attendance for the last year 670. There are no pupil teachers in the school. It would be impossible for me to take a class myself, and at the same time to perform all the branches of my work properly. The boys and girls are taught together, but they are entirely separate in the playground. They leave the school by separate doors. I find no disposition on the part of the boys and girls who are taught together to play together.

I am acquainted with the principles of Kindergarten. It would be possible to carry on these principles in the upper school provided that an amount of freedom were allowed which the present code does not give. I should like to see some kind of manual employment in all the Standards. By manual training I do not mean that there should be working with tools; for example, I should like to see the children in Standard III. learn to make a cabbage or onion net to relieve them from the tedium of ordinary lessons. Working in wood and iron, and leather, turning wood, etc., might be tried. If I had latitude under the Code I should be disposed to take the children on leaving the Infants' School and extend the Kindergarten principle to the higher manual training. I think I could organise such an experiment in my school. I believe that Kindergarten, where successfully taught, as on the Continent, is nearly always confined to very small numbers. In each class much individual attention is required. To teach Kindergarten to 60 children is an impossibility. I should think 30 children might be taught successfully by one teacher. I do not consider that the children could be classified so that while one teacher was taking Kindergarten with 30 children another could be teaching 90 children. An object lesson, however, might be given to 90, but it would depend on the nature of the lesson.

The manual training at Beethoven Street School is taught on two afternoons a week to boys in the 7th Standard. Each class consists of about 20 boys. The instruction is carried on by the school-keeper, a carpenter by trade, under the superintendence of myself. Working in soft wood such as deal or pine has been tried and many articles have been made. The object of the work is to make the lads handy, and not to give instruction in a particular trade. A pleasant relief to the ordinary school work is also afforded. Another important object I had in view was to induce the children to stay longer at school. As soon as they have passed the 4th Standard they are disposed to leave. I notice that this year the 6th Standard has been very largely retained, by the hope that when they enter the 7th Standard they would commence this work. During the first year of manual training there were a few 6th Standard boys, but only sufficient to make up the requisite number. Last year all the boys were in Standard VII. The instruction is very popular both with the parents and scholars. Only one objection has been raised to it; in that case the parent preferred her son doing the ordinary school work. It was more the objection of a fanciful mother than a Trades' Union objection.

I should be disposed to extend the teaching to the 6th and even to the 5th Standard, but of course only a limited number could be taught at the same time—20 at the most. The attendances of the boys at the Beethoven Street class have not hitherto been counted in the total attendances, but I hope that this year this difficulty will be overcome. I have drawn up and submitted to H.M. Inspector for his approval, a scheme of manual instruction in accordance with Article 16 of the New Code. The scheme is as follows:—

First Year's Work.

(1) An elementary knowledge of the chief woods used in carpentry.

(2) To use and describe the following tools:—

Hammer.	Bradawl.	Chisel.	Plane.
Mallet.	Gimlet.	Saw.	Screw-driver.
Nail-punch.	Pincers.	Rule.	Marking-gauge.
Square.			

(3) To sharpen and adjust plane-irons and to sharpen chisels.

(4) To have an elementary knowledge of the different kinds of nails, brads and screws, to bore holes for them of proper size with bradawl and gimlet, or brace and bit, to drive nails, screws, etc.

(5) To sink nail heads with punch, to counter-sink screw heads with chisel, gouge or proper counter-sink in brace.

(6) To explain and make halfing and lap-joints, also mortice and tenon, and common dovetail joints.

(7) To know how to stain, size, glue and varnish a piece of wood.

(8) To be able to make a double pen-tray or a small time-table frame.

Approved on behalf of the Education Department this seventh day of June 1887.

(Signed) ADAM RANKINE,
H.M. Inspector of Schools.

This scheme has been drawn up so that the subject can be examined upon on paper and be practically worked in the presence of the Inspector. If this scheme is adopted the boys in the 7th Standard will no longer be presented in Chemistry, although the subject will still be taught.

By the introduction of manual work, Drawing is brought into close relation with it, and the practical application of Drawing is seen. Geometry and Drawing to scale are also taught in conjunction with

the Manual Instruction. Now that Drawing is under the Science and Art Department, I think that greater latitude in teaching will be possible.

I do not think that girls require more manual training than what they receive at present in Cookery and Needlework, supplemented by Swedish Drill. Cookery is fairly popular with the girls.

Physical training does not, as a rule, receive sufficient attention in Board Schools. I think that the pressure of the Code prevents the proper attention being given to physical instruction. I should like all boys and girls taught the use of the gymnastic apparatus in the playground. At present it is only done in a spasmodic way. Teachers would very likely object to give two hours a week out of school hours to teach the subject.

I should like to see some scheme of drill and gymnastics adopted. If it were adopted either as a 'class' or 'specific' subject, a great stimulus would be given to physical instruction. I should be pleased to draw up such a scheme.

Lawn tennis used to be played in the girls' playground at Beethoven Street School, but had to be discontinued on account of the rule adopted by the Works Committee. The teachers and elder children used to play together, and sometimes the children, who had by playing with the teachers become acquainted with the game, would play without the teachers. The use of part of the playground for lawn tennis in no way affected the use of it by the children. The game was played between 12.30 and 1.30, as it would not have been wise to play when there were a great number of children present. Several teachers who used to stay in school during the dinner time were tempted to join the play.

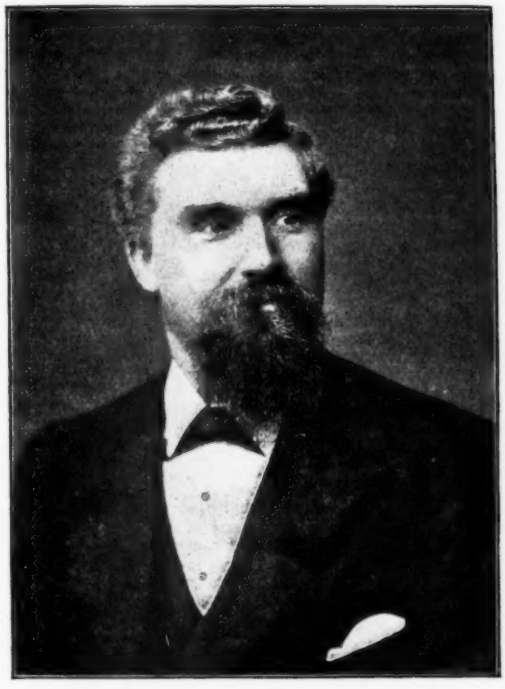
There is a course of object lessons in Standards II., III., and IV. which is intended to lead up to the Chemistry and Botany in the Fifth and higher Standards. In the Fourth Standard the instruction becomes specific.

It is proposed to give object lessons on carpenters' tools, etc., at Beethoven Street, to aid the instruction in manual training which is to follow. Theoretical technical instruction, unless it is followed by manual instruction, is practically useless.

English Composition might be begun in a very elementary way in Standard III., and parsing done away with altogether. The difficulties of grammar could be met with as they arose, and treated in a concrete, instead of in an abstract, manner. I am afraid Spelling must be partially taught as a separate subject apart from Reading. The Government requirements of Spelling are too high; Individual Examination in Spelling should be left till the Fourth Standard is reached; for the lower Standards Class Examination should be substituted.

These are the opinions, hopes, and aspirations of seven years ago, and the selection of this as a Higher Grade School, and its recognition as such by the Education Department, have enabled many of them to be realised. With a school staff strengthened by the addition of a skilled art master and his assistant, and a gifted specialist for the workshop, the higher branches of study have been undertaken with much undoubted success, as our readers will see below.

Military Drill has been given up, and the Mixed Classes have physical exercises based upon the Swedish Method. The Workshop has been entirely reorganised, and placed under the supervision of Mr. D. Bryant, a Silver Medallist in Carpentry, who has all the boys in turn from Standard V. and upwards under his tuition, the practice going on from Monday morning to Friday night in classes of about 20 at a time. The course of bench-work is that arranged by Mr. S. Barter in his 'Woodwork, or English Sloyd' (Whittaker & Co.). Hand and Eye Training is now the ordinary work of the lower standards; in fact, a complete system of Manual Training has been arranged for all classes in the school, the course embracing drawing and colouring in crayon, coloured paper designing, cardboard-work, brush-work in colour, clay-modelling, and woodwork. Every class in the school is also occupied with English Composition, either oral or written, and the difficulty of grasping this subject in the upper standards has been thus completely mastered. The effect of all these changes and improvements has been, that the old trouble of children leaving school at Standard IV. has disappeared, and the parents willingly and in large numbers extend their children's school life to avail themselves of the fuller educational advantages offered.



Ira Wm Tate

It will be observed that the school is divided into 12 separate classes, each having its own room and under the charge of a separate certificated assistant. Appreciating to the full the great advantage of this classification, Mr. Tate was not content to work on Code lines. Therefore he drew up a scheme of instruction suitable to his circumstances, which we reproduce.

A ROOM.—CLASS 1. (HIGHEST).

Reading. — To read fluently from — 1. Shakespeare's 'King John.' 2. Scott's 'Ivanhoe.' 3. Johnson's 'Botany Reader.' 4. Comprehensive Reader.

Writing.—1. English Composition. 2. Copy Books.

Mathematics.—Science Subject (V.) (First Stage).

Botany. — Science Subject (XV.).

Chemistry (Inorganic). — Science Subject (X.).

Art.—Freehand Outline, *Model Drawing, Clay-modelling, Light and Shade.*

Shorthand.—Pitman's Teacher.

French.—Bué. First French Book with Elementary Conversation.

Singing.—Tonic Sol-fa leading to Old Notation.

Drill.—Swedish Physical Exercises.

Manual Training. — Woodwork.

General Information. — Current events, &c.

B ROOM.—CLASS 10.

Reading.—To read fluently from Reading Books — 1. Longman's 'Fairy Tales.' 2. Longman's 'Geographical Readers.' 3. Nelson's 'Stories of Common Things.'

Writing.—Dictation (six lines). Copy Books.

Arithmetic.—Former Rules, Division (Short and Long), Mental Arithmetic (Money).

Recitation.—'The Wind in a Frolic' (W. Howitt), 51 lines.

Geography. —Physical and Political Geography of England and Wales.

English.—Pointing out Nouns, Verbs, Adjectives, and Pronouns. Written Composition on a short Story.

Object Lessons.—See Board Scheme.

Singing.—See Board Code.

Drawing.—Freehand and Ruled Drawing (III.).

Needlework.—See Code.

Drill.—Swedish Physical Exercises.

Hand and Eye Training.—Coloured Paper Designs.

C ROOM.—CLASS 2.

Reading.—To read fluently from—1. Shakespeare's 'Merchant

of Venice.' 2. Longman's 'History Readers.' 3. Longman's 'Geography Readers.'

Writing.—A longer theme or letter than in Class 3. Note or Exercise Books to be shown.

Arithmetic.—Former Rules, Compound Interest, Stocks, Mental Arithmetic.

Recitation.—'Trial of Antonio' (Shakespeare).

Geography.—Physical and Political Geography of United States, and Productions and Trade with British Isles.

English.—Analysis of Complex Sentences. Précis as in Class 3, and Exercises in the right use of Commercial Terms.

Botany.—Comparison of a Fern and Moss with a flowering plant. The formation of different kinds of fruits. Structure of a bean and grain of wheat or barley. The phenomena of germination.

Chemistry.—Properties of Carbon and its chief inorganic compounds. Differences between metallic and non-metallic bodies. Combination by weight and volume. The use of Symbols and Chemical formulæ.

Singing.—See Board Code.

Drawing.—Freehand, Light and Shade, Solid Geometry (Boys).

Needlework (Girls).—See Code.

Drill.—Swedish Physical Exercises.

Hand and Eye Training.—Claywork.

Manual Training (Boys).—Woodwork.

French.—Bué. First French (First Part).

Shorthand.—Pitman's Teacher.

D Room.—Class 3.

Reading.—To read fluently from—1. Longman's 'Geographical Readers.' 2. Longman's New 'Readers.' 3. Longman's 'History.'

Writing.—A theme or letter. Composition, spelling, and handwriting to be considered. Note and Exercise Books to be shown.

Arithmetic. — Former Rules, Averages, Percentages, Mental Arithmetic.

Recitation.—'Trial of Antonio' (Shakespeare).

Geography.—Physical and Political Geography of Africa, and Productions and Trade with British Isles.

English.—Analysis of Complex Sentences. Précis or abridgment of a document or statement of its most important contents.

Botany.—Comparison of a Fern and Moss with a flowering plant. Formation of the different kinds of fruits. Structure of a bean and grain of wheat or barley. The phenomena of germination.

Chemistry.—The properties of Carbon and its chief inorganic compounds. Difference between metallic and non-metallic bodies. Combination by weight and volume. The use of Symbols and Chemical formulæ.

Singing.—See Board Code.

Drawing.—Freehand, Model, Solid Geometry (Boys).

Needlework (Girls).—See Code.

Drill.—Swedish Physical Exercises.

Hand and Eye Training.—Brush work in Colour, Clay-work.

Manual Training (Boys).—Woodwork.

Laundry (Girls).—The Board's First Course.

French.—Bué. First French (First Part).

Shorthand.—Pitman's Teacher.

E Room.—Class 4.

Reading.—To read fluently—1. Blackie's 'Comprehensive Readers.' 2. Gill's 'History Reader' (IV.). 3. Cassell's 'Citizen Reader.'

Writing.—A short theme or letter on an easy subject. Spelling, handwriting, and composition to be considered. Copy Books.

Arithmetic.—Former Rules, Proportion (Simple and Compound), Simple Interest, Mental Arithmetic.

Recitation.—'Ancient Mariner' (Coleridge), 189 lines.

Geography.—Physical and Political Geography of Asia, and Productions and Trade with British Isles.

English.—Analysis of Compound Sentences, Commercial Correspondence, Correction of common errors.

Botany.—Structure of Wood, Bark, and Pith. Food of plants and the manner in which a plant grows. Functions of root, leaves, and different parts of a flower. Cells and vessels.

Chemistry.—Preparation and Properties of Common Gases,—H, O, N, Cl. The chemical characters and constituents of pure air and pure water, and the nature of the impurities found in both. Effects of plants and animals on air.

Singing.—See Board Code.

Drawing.—Freehand, Model, Solid Geometry (Boys).

Needlework (Girls).—See Code.

Drill.—Swedish Physical Exercises.

Hand and Eye Training.—Brush work in Colour, Claywork.

Manual Training (Boys).—Woodwork.

Shorthand.—Pitman's Teacher.

F Room.—Class 5.

Reading.—To read fluently from Reading Books—1. 'The Laws of Every Day Life.' 2. Longman's 'New Geography.' 3. 'Hereward, the Wake' (Kingsley).

Writing from memory a story of forty lines of manuscript, or a short original letter of twenty lines long. Copy Books.

Arithmetic. — Former Rules, Vulgar and Decimal Fractions, Mental Arithmetic.

Recitation.—'Ancient Mariner' (Coleridge), 189 lines.

Geography.—Physical and Political Geography of Australasia. Productions and Trade with British Isles.

English.—Parsing and Simple Analysis, Building Sentences.

Botany.—Structure of Wood, Bark, and Pith. Food of plants and the manner in which a plant grows. Functions of root, leaves, and different parts of a flower. Cells and vessels.

Chemistry. — Preparation and Properties of Common Gases,—H, O, N, and Cl. The chemical characters and constituents of pure air, water, and the nature of the impurities found in both.

Singing.—See Board Code.

Drawing.—Freehand, Model, and Geometry.

Needlework (Girls).—See Code.

Drill.—Swedish Physical Exercises.

Hand and Eye Training.—Cardboard Work.

Manual Training (Boys).—Woodwork.

G Room.—Class 6.

Reading. — To read fluently from Reading Books—1. Stories from Fenimore Cooper's 'Tales.' 2. The 'Charles Dickens Reader.' 3. Longman's 'New Geography.'

Writing from memory a story of thirty lines of manuscript (Exercise-book size). Copy Books.

Arithmetic.—Former Rules, Single Rule of Three by method of unity, Addition and Subtraction of proper fractions (denominators under 12), Mental Arithmetic.

Recitation.—'The Building of the Ship' (114 lines), Longfellow.

Geography.—Physical and Political Geography of Europe, and Trade with the British Isles.

English.—Parsing, Simple paraphrase, Correction of sentences containing common faults of speech.

Botany.—Characters of roots, stems, leaves, and parts of a flower, illustrated by common flowering plants.

Chemistry.—Elementary and Compound Matter. Illustration of combination and decomposition in such bodies as HCl, HgO, H_2O, FeO.

Singing.—See Board Code.
Drawing.—Freehand, Model and Geometry (V).
Needlework.—See Code.
Drill.—Swedish Physical Exercises.
Hand and Eye Training.—Cardboard Work.
Manual Training (Boys).—Woodwork.

H ROOM.—CLASS 7.

Reading.—To read fluently from Reading Books—1. Longman's 'New Readers' (V). 2. Longman's 'History Readers' (V). 3. 'Tales from Henty.'
Writing from memory a short story read out twice. Spelling, handwriting, and correct expression to be considered. Dictation may be substituted. Copy Books.
Arithmetic.—Former rules, Practice (Simple and Compound), Bills of Parcels, Mental Arithmetic.
Recitation.—'The Building of the Ship' (85 lines).
Geography.—Productions, internal and external Trade of British Isles, Latitude and Longitude, Day and Night, Circumstances which determine climate.
English.—Parsing, Simple Paraphrase, Building Sentences.
Botany.—Character of root, stem, leaves, and parts of a flower, illustrated by specimens of common flowering plants.
Chemistry.—Elementary and Compound Matter. Illustration of combination and decomposition in such bodies as HCl, HgO, H_2O, FeO.
Singing.—See Board Code.
Drawing.—Freehand and Scale Drawing.
Needlework (Girls).—See Code.
Drill.—Swedish Physical Exercises.
Hand and Eye Training.—Coloured Paper Designs.
Manual Training (Boys).—Woodwork.

J ROOM.—CLASS 8.

Reading.—To read fluently from Reading Books—Longman's 'New Reader' (IV). 2. Gatty's 'Parables from Nature.' 3. 'Swiss Family Robinson.'
Writing.—Dictation, on paper, of 8 lines of poetry or prose. Copy Books.
Arithmetic.—Former Rules, Compound Rules (Money), Reduction of Weights and Measures, Mental Arithmetic.
Recitation.—'The Wives of Brixham' (80 lines).
Geography.—Physical and Political Geography of Ireland and British North America.
English.—The Parts of Speech (fuller), Transposition of simple poetry into prose, Building Sentences.
Object Lessons.—See Board Scheme.
Singing.—See Board Code.
Drawing.—Freehand and Scale Drawing.
Needlework.—See Code.
Drill.—Swedish Physical Exercise.
Hand and Eye Training.—Coloured Paper Designs.

K ROOM.—CLASS 9.

Reading.—To read fluently from Reading Books—1. Longman's 'New Reader' (III). 2. Longman's 'New History.' 3. Longman's 'Swiss Family Robinson.'
Writing.—Eight lines of prose slowly read once and then dictated.
Arithmetic.—Former Rules, Reduction of Money, Compound Addition, Subtraction, Multiplication, Mental Arithmetic, Weight and Measure Table (one figure).
Recitation.—'The Wives of Brixham' (80 lines).
Geography.—Physical and Political Geography of Scotland.
English.—The Parts of Speech, Simple Composition (Longer Story).
Object Lessons.—See Board Scheme.
Singing.—See Board Code.
Drawing.—Freehand and Ruled Drawing.
Needlework.—See Code.
Drill.—Swedish Physical Exercises.
Hand and Eye Training.—Coloured Paper Designs.

L ROOM.—CLASS 11.

Reading.—To read fluently from Reading Books—1. Longman's 'New Reader' (II). 2. Nelson's 'Royal Reader' (II).
Writing, on paper.—1. Transcription. 2. Dictation (six lines). 3. Copy Books.
Arithmetic.—Notation and Numeration up to 500,000, Addition, Subtraction, and Multiplication (three figures), Short Division, Multiplication Table, and Pence Table to 12s.
Recitation.—'The Squirrel' (Norman Macleod), 40 lines.
Geography.—The work of Class 12 more fully, Geography of Middlesex, Physical Geography of Hills and Rivers.
English.—Oral Composition on a short story. Nouns and Verbs.
Object Lessons.—See Board Scheme.
Singing.—See Board Code.
Drawing.—Freehand and ruled on paper by straight lines and simple curves.
Needlework.—See Code.
Drill.—Swedish Physical Exercise.
Hand and Eye Training.—Coloured Crayons, Designs (ruled).

M ROOM.—CLASS 12.

Reading.—To read fluently from Reading Books—1. Longman's 'New Readers' (II). 2. 'Century Readers' (Blackie) (II).
Writing, on paper.—1. Transcription. 2. Dictation (four lines). 3. Copy Books.
Arithmetic.—Notation and Numeration up to 100,000, Addition, Subtraction, and Multiplication (two figures), Multiplication Tables, and Pence Table to 8s.
Recitation.—'The Squirrel' (Norman Macleod), 40 lines.
Geography.—Size and shape of the Earth, Geographical terms simply explained and illustrated by reference to Map of England, Globe model and diagrams.
English.—Answering Questions orally in whole sentence.
Object Lessons.—See Board Scheme.
Singing.—See Board Code.
Drawing.—Freehand and ruled on paper by straight lines and curves (simple).
Needlework.—See Code.
Drill.—Swedish Physical Exercises.
Hand and Eye Training.—Ruled Designs in Coloured Crayons.

This scheme will be seen to be very extended in its range, and to embrace a large number of subjects. Mr. Tate was most careful to point out that such a comprehensive scheme could only be carried out with success in schools as fortunately circumstanced as Beethoven Street, with its large and efficient staff, many of whom are specialists, its complete equipment of apparatus, and its children drawn from careful and orderly homes.

Occupying a conspicuous position in the Central Hall is the Honours Board, whereon are displayed the names of those children who have brought credit to their school and life-long profit to themselves by gaining scholarships in open competition. Here is the list :—

BEETHOVEN STREET (HIGHER STANDARD) SCHOOL, HONOURS LIST.

Name.	Scholarship.	Annual Value.	Tenure.
William Perry	Sir John Bennett	£24	4 years.
William Garland	Mitchell	£10	2 ,,
Eleanor E. Slatter	Drapers'	£30	4 ,,
Faithful B. Chenoweth	Mitchell	£30	3 ,,
James Hedges	Saddlers'	£30	2 ,,
Mary E. Day	Clothworkers'	£30	4 ,,
Ellen H. Foulger	Drapers'	£30	4 ,,
Elizabeth J. Coventry	St. Dunstan's	£30	4 ,,
Albert E. Parmee	Mitchell	£30	3 ,,
Geo. E. Huckle	Christ's Hospital	£50	4 ,,
Edith J. Howe	L. C. C.	£10	2 ,,
Ada Dunstan	,,	,,	2 ,,
Walter Spencer	,,	,,	2 ,,
Arthur Stanton	,,	,,	2 ,,
Sidney Herbert	,,	,,	2 ,,
Will Jacobs	,,	,,	2 ,,

We may add that in June last Elizabeth J. Coventry passed in the 1st Division of the London Matriculation, being only 16 years of age at the time.

This same Central Hall is embellished with many fine specimens of the children's work; but to our mind the most notable of all these interesting mural adornments is the portrait of the Head Master himself, whereby hangs the following tale, told in the words of the old scholar whose handiwork the very

excellent likeness is. We extract the account from the flourishing school magazine, *The Scholar's Own* (adapted):—

Mr. Philip, an old scholar, sends a short account of how he designed and worked the portrait of Mr. Tate, which he presented to the school a short time ago, and which now hangs in the hall. We feel sure our scholars will be pleased to know the *modus operandi* of engraving.

He says: "The ornamental border is designed from a print by Michel Dorigny which is in the British Museum. The portrait is cut on ivorine. The design was first drawn out on paper, and then copied on to the metal, previously 'surfaced' and 'squared.' The 'surface' was obtained by 'flattening' the metal on a steel bench, 'levelling' with a coarse file, taking out the file marks with pumice stone, and the pumice stone marks with 'Water of Ayr' stone.

"The outline of the drawing on the plate was cut with a 'graver,' which is a square bar of steel sharpened to cut with one corner. The whole plate within the outline was then painted over with black japan to resist the acid with which the background was sunk. This process gave a raised appearance to the ornament. It was then completed by elaborate shading with the 'graver.' The oval was then cut out, the inscription engraved, and the whole plate 'gilt.'

"The portrait was cut with the graver, but in an entirely different style, it being an illustration of 'copper-plate' cutting. Prints could be taken from it as if it were copper, only that the lines are filled in to darken them. Ornament cutting must be free and decided: cutting to print from, is a continuous elaboration of details until the right effect is obtained.

"The elementary drawing I learnt at school has been of great assistance to me, more particularly the 'trueness of eye' acquired there. 'Trueness of eye' is essential in engraving."

At the time of our visit the science and art results for 1894 had all been received, and a very interesting page they constitute in the September issue of the Beethoven Street *Scholar's Own*, as the following summary will testify:—

ART.—(1) *Clay Modelling:* First Class 16, Second Class 8. (2) *Freehand Outline:* First Class 5, Second Class 8. (3) *Model Drawing:* First Class 5, Second Class 14. (4) *Light and Shade:* Second Class 5. (5) *Second Grade Prospective:* Second Class 1. (6) *Third Grade Freehand Ornament:* First Class 1. (7) *Third Grade Model Drawing:* First Class 1. (8) *Practical Plane and Solid Geometry:* Fair 1.

SCIENCE.—(1) *Mathematics:* Pass 16; Fair 11. (2) *Botany:* Pass 24; Fair 4. (3) *Chemistry:* Pass 29; Fair 6.

We have already referred to the School Board Exhibition that was held in the Hugh Myddelton School in July. How well Beethoven Street 'kept the bridge' will be evident from the list of successes.

Drawing.—Outline from growing plant. First Class: Charles Doble, Leonora Stanton. Second Class: Frederick Roberts, John Nener. Third Class: Ernest Hall. Outline from cast. Third Class: Robert Coventry. Light and Shade. Special Merit Prize: Leonora Stanton. First Class: Charles Doble, William Jacobs, William J. Williams. Second Class: Robert Coventry. Third Class: Kate Coast.

Colour Design.—First Class: Ethel Beavis. Second Class: Charles Doble, Mary Sheffield, Herbert Halls. Third Class: Robert Webber. Commended: William Gurd.

Class Work.—Coloured Paper Design: Standard III., Third Prize. Standard II., Commended. Freehand: Standard III., Prize. Standard II., Commended.

Cardboard Work.—First Class: Charles Doble, Frederick Roberts.

Clay Modelling.—First Class: Leonora Stanton, Albert Shrimpton, Henry Wadsworth, Albert Grimditch, Elizabeth Hambly.

Woodwork.—Special Merit Prize: Harry Sillick. First Class: Charles Doble, Albert J. Webb. Second Class: Walter Spencer, Albert Shrimpton, Frederick Roberts, Frederick Lemoine, Arthur Ludbrooke, Reginald Baxandall, William Young. Third Class: Arthur Stanton, William Fletcher.

The foregoing affords ample proof of the fact that Mr. Tate has not 'played to the gallery' (if H.M.I.'s will permit us to apply such a vulgarism to them) but looked to all-round development. Notwithstanding (or perhaps because of) this, the inspectorial commendation is almost wearying in its unvaried laudation,—Matthew Arnold, lovable Mr. Campbell, Mr. Willis, and again Mr. Helps—all telling the same tale concerning the quality of the work of Mr. Tate's hands. Here is the last specimen, from which, as the commercials say, the rest may be judged.

Beethoven Street School.—Report for 1894.

MIXED SCHOOL.—This school, which is a centre of intellectual activity, is doing admirable work in training children in habits of order, accuracy, and neatness, equipping them with much useful knowledge, developing their faculties by means of observation and experiment, and cultivating their artistic sense by means of Drawing, Modelling, Woodwork, Music, etc. I am glad to find cricket and lawn tennis clubs. The string band, which has made great progress during the past year, gave a very creditable performance. Four County Council Scholarships were gained last year, and the number of scholars who pass the Science and Art Examinations steadily increases.

'To what do you attribute your success?' we venture to ask Mr. Tate, when, after a most gratifying peep into all the class-rooms, we were again in the chief's sanctum. 'In the first place,' was the reply, 'the school is entirely my own organization. I opened it, and for thirteen years I have tried to embrace every opportunity for improvement that has presented itself. Secondly, I have always been fortunate in my staff, of whose devotion to their work the most callous of mortals must be proud; and thirdly, I have been most ably supported by the efforts of the children and their parents.'

The happiness of his teachers is regarded by Mr. Tate as one of his chiefest cares. In this connection it is interesting to note that several members of his staff, if not actually 'bred, born and reared' at the two schools under his management, have not fallen far short of this, having passed the greater part of their lives therein as scholars, pupil-teachers, and now as class masters, a fact that speaks volumes for the kindly feeling that Mr. Tate's *régime* has engendered, which again is proved by the great success of the annual gathering of old scholars.

True to its name, Beethoven Street 'is mov'd with concord of sweet sounds,' which side of the school's development supplies ample proof of well-developed interest on the part of the parents. And this interest has been translated into pounds, shillings and pence to such an extent that the orchestra possesses a ten-guinea 'cello and many other instruments of great value, no less a sum than £32 having been subscribed for the purpose of providing instruments, whereon sweet music might be discoursed to the edification of thousands of budding English men and women.

In connection with instruction in Botany, which is in the able hands of Mr. Paulson, an accomplished enthusiast and Honoursman in this branch of science, frequent visits are paid to Kew Gardens and other places; furthermore, an admirable collection of slides illustrates to perfection the structure of the various tissues to be studied. This brings us to the school microscope, concerning which we were treated to the recital of a little incident that brought out into bold relief Mr. Tate's keenness and pertinacity when the interests of his school are concerned. He had requisitioned a microscope, and a crazy tumble-to-pieces affair was sent, requiring one's undivided attention to correct its frailty. When

Mr. Tate sent this back to the Board stores, intimating that it was not what he wanted, he took care to send back full details, and even a drawing in illustration, of what he did want. In addition he named the firm that was prepared to work out his ideas. Importunity having conquered, so pleased were the Board with the Tate instrument that the first one made was bought by Mr. Diggle, the second finding its way to Beethoven Street. The peculiar feature of the instrument is a clamp which enables the investigator to securely retain the object in one and the same position, so that the last observer sees exactly what was seen by the first—no mean advantage, as will be readily recognized by all who have ever exhibited slides to a number of children.

The pioneer work of the school causes it to be visited by educationists from all quarters of the globe. The impressions of these visitors are recorded in the book kept for this purpose, and good reading many of them afford. For example, a Spaniard wrote as follows:—'*With the best wishes for the prosperity of the school, hoping that it will be succeed very much in both: in mixed classes and in the introduction of manual work.*' Whilst an American hailing from California, perhaps influenced by the name of the place, put his appreciation in the following expressive, if terse form: '*more pleasing than the opera.*'

Another object of interest was a bulky tome that had gone through fire and water at the Chicago Exhibition, and had come out not much the worse for its experiences. It contained the written work—admirable in every respect—that had been sent by Beethoven Street to the great World's Fair. We were pleased to note that this contribution was not an artificial, because a picked one, but that there was a paper from almost every individual member of all the classes.

And so we might go on in our recital of the many interesting and edifying things that came under our notice whilst visiting this truly admirable school, but we are warned that we have already exceeded the just limits of our space, so that with a few personal notes this record of our pleasant remembrances must come to a close.

'My educational sponsor was the third President of the Union, Mr. Osborn,' said our host with evident pride and affection, at the same time that he produced evidence of his master's success and of his own desire to keep his master's memory green; 'and I am also deeply indebted to Mr. Richard Balchin, who, as my Class Master at Hope Street School, York, did much to impress me with a high ideal of the teacher's calling and of his own worth.' Here again it required no great insight to distinguish a strong feeling towards Mr. Balchin, in which all who know the author of 'Tact in the business of School-keeping' will join. From Hope Street Mr. Tate proceeded to Borough Road Training College, whence he departed to control the destinies of the Brentford British School. So effectually was this control carried out that the school was mentioned in the Blue Books for 1873, 1877 and 1879. It was here that Mr. Tate was inspected by Matthew Arnold, of whom he relates many little anecdotes, all tending to show the amiability of the 'apostle of sweetness and light.' When in 1881 it became necessary for Mr. Tate to leave Brentford for the 'fresh fields and pastures new' represented by Beethoven Street Schools, he did so to the regret of all who knew him. This had been declared unto us by many before we had come into personal contact with Mr. Tate. At a public meeting held on April 15th, 1881, at the schools, over which Mr. Willis, H.M.I. for the district, presided, and which was attended by all the local educationists, valuable testimonials in recognition of the worth of our well-known teacher's 16 years' work in Brentford were presented to him, and we cannot do better than conclude our sketch in the words that Mr. Willis made use of on this occasion, and which so aptly express Mr. Tate's aims: '*After all, the object of a school is not merely to teach reading, writing, and arithmetic, but to make men and citizens of the boys, and this is the kind of thing that has been accomplished in these schools very thoroughly.*'

'ARE WE BETTER OR WORSE THAN WE USED TO BE—AND BY HOW MUCH?'

A HUMOROUS DEBATE FOR BOYS.

BY JOSEPH DESPICHT.

Author of Prize Play, 'In 1999,' 'Should Men wear Hats?' etc.

(*Time in performance, 30 mins.*)

(*Continued from page 181.*)

11TH SPEAKER, R.*

Mr. Chairman and 'end-of-the-century' wiseacres, we read continually of the good *old* times; and without doubt the *present* are very bad times. (Hear, hear!) Now, as bad can never be better than good, and good must always be better than bad, so it logically follows that the 'Good Old Times' must have been better than the present bad times, 'Which,' as 'geometrical' old Euclid would have said, 'was to be demonstrated!' (Hear, hear! and laughter.)

No, the fact is, we go too fast now-a-days to accomplish anything that shall last and live. The pleasant old jog-trot, jog-trot, jog-trot is over, and everybody gallops madly on, till at the first formidable obstacle, over he goes a regular cropper. (Hear, hear! on Right.) I shall vote for the steady old files and against the 'Brummagem Ware' of the present day. (Hear, hear! Oh, oh! All rise to speak. Chairman says: 'Mr. M—— was first on his legs!")

12TH SPEAKER, L.

Sir, it seems to have been accepted as a truism in this debate, that the days of chivalry are over. (Hear, hear! on Right.) But this I utterly and emphatically deny. (Hear, hear! on Left.) Do we read of nothing but crime in our newspapers? Here is the other side of the picture, and I will let the story speak for itself. (Reads from newspaper.)

'On Saturday, December 15th, a little before midnight, and during a terrific gale and snowstorm, the brig "Fairy Jane," from South Shields, stranded on the rocks at Upgang, near Whitby. No sooner did the fact become known than the lifeboats at Whitby and Upgang were launched, manned by a crew of heroes as noble as ever breathed! (Hear, hear!) Through a terrific sea, on they struggled, vying only with each other in their efforts to render the first assistance!

'No less than thirteen times was the Upgang lifeboat hurled back by the waves, while the jagged rocks tore the sides of the boat from Whitby like the horns of an angry bull.

'For hours and hours through that fearful night these men stuck to their tasks; and when all hope of a rescue had to be aban-

* 'R' and 'L' signify 'Right' or 'Left of Speaker.

ARITHMETIC.—Lock's 'Arithmetic for Schools,' Macmillan; Pendlebury's 'Arithmetic,' Bell & Co.; Brook-Smith's 'Arithmetic,' Macmillan; Collar's 'Notes on the Metric System,' Macmillan; Dixon and Beach's 'Girl's Arithmetic,' Hughes, 3s. 6d.; C. Smith's Arithmetic,' Cambridge Press.

EUCLID.—Hall and Stevens (in parts or together), Macmillan; Deighton's 'Euclid,' I. and II., Bell.

ALGEBRA.—Hall and Knight's, 'Elementary Algebra,' Macmillan. [Girls should master at least either Hall and Knight's 'Algebra for Beginners,' Macmillan; or Harvey's 'Easy Steps in Algebra,' Hughes, 6d.]

GEOGRAPHY. — (*a.*) Text-books: Meiklejohn's 'Geography,' Holden; Brooke's 'Descriptive Geography,' Hughes, 3s. 6d.; Gill's 'Student's Geography.'

(*b.*) For further study: Gregory's 'Elementary Physiography,' Hughes, 2s. 6d.; Scott-Keltie's 'Applied Geography,' Philip; Cassell's 'Higher Class Readers' (these will be found very interesting and instructive); Geikie's 'Teaching of Geography,' Macmillan; Green's 'Geography of the British Isles,' Macmillan; Dawson and Sutherland's 'Colonies,' Macmillan; 'Handbooks for Colonies,' Eyre and Spottiswoode, 1*d.* each, or 2s. bound together. Pupil Teachers should also read books of travel, and with the help of a Gazetteer and Atlas a great deal of geography may be learned from a newspaper. Thus the 'Shipping Intelligence' alone suggests a great fund of information on commercial and general geography. We see for instance the name of a port or point given, followed by the name of a ship with her starting place or destination or both, *e.g.*, *Aden*. 'Reichstag,' from Algoa Bay for Hamburg. 'Oriental,' from London for Bombay, arrived.

Let the student ask, 'Where is Aden? To whom does it belong? Of what use is the port? Where is Algoa Bay? Where is Hamburg? What route did the ship take? What cargo would the ship probably carry from Algoa Bay to Hamburg? With what would she return? And so on. This practice will be found most interesting and of great value in revising the geography of the world. It should be laid down as a golden rule that no name of a place should be passed without searching the Atlas for it unless it be a very familiar place.

HISTORY.—(*a.*) Text-books: Meiklejohn's 'History of Great Britain'; Carpenter and Green's 'British History,' Hughes, 2s. 6d.; Ross's Manual, Simpkin, Marshall; Edith Thomson's 'History,' Macmillan.

(*b.*) Synopses. In addition to a text-book in this subject, a summary should be used for purpose of recapitulation: Green's 'Main Facts and Dates,' Hughes, 8d.; Sanderson's 'Summary of British History,' Blackie; Haughton's 'Summary,' Philip.

(*c.*) For further study and reference: Green's 'Short History' (with analysis), Macmillan; 'Twelve English Statesmen,' Macmillan; 'Student's Hume,' Murray.

In addition to these the Pupil Teacher should read historical novels, such as Sir Walter Scott's, always taking care to see whether the writer follows the history or alters it to suit the purposes of his novel. This critical reading is in itself a valuable training.

TEACHING. — Flux's 'School Management,' Hughes, 1s. 6d.; Gladman's 'School Management'; Taylor's 'Notes of Lessons.'

MUSIC.—Dunstan's 'Manual of Music,' Allen.

READING AND RECITATION.—Strange to say these two subjects are among the most unsatisfactory. The Pupil Teacher will find valuable hints in Hawkins 'Reading and Reciting,' Hughes, ; and also in Prof. Meiklejohn's 'Expressive Reading,' Holden. The rules for good reading are few and the Pupil Teacher must put them in practice by reading *aloud* at home, and by reading passages as a model to his class. The recitation should be taken from the work of some good author, and the whole work should be studied, and all striking passages committed to memory in addition to the few specified lines. For the coming year we suggest the study of Keats' 'St. Agnes' Eve,' for 1st and 2nd years, and Shakespeare's 'Richard II.,' for 3rd and 4th, and shall from time to time give advice on the way to study them, and set questions on the works. Keats' Complete Works are published by Routledge, 2s., and annotated editions of 'Richard II.,' by Macmillan, Clarendon Press, &c.

COPY-SETTING.—Hughes' Pupil Teachers' Copy-book (1s.) not only cultivates an excellent style, but contains excellent little hints on teaching writing.

LATIN.—Huxley's 'Latin,' Hughes, is an excellent introductory book; Smith's 'Principia,' Murray; 'Cæsar,' Books I. and II., 'Virgil,' Book I., Macmillan; 'Cæsar I.,' and 'Virgil,' Book I., University Correspondence Press.

NEEDLEWORK.—Miss Rosevear's 'Needlework for Older Girls,' Macmillan, and Text-book.

DOMESTIC ECONOMY.—Hughes' 'Domestic Economy,' 4s. 6d.; Macmillan's 'Primer'; Mrs. Lord's 'Laundry Work,' Hughes, 8d.; Tegetmeier's 'Household Management,' Macmillan.

FRENCH.—Darqué's 'Elementary French Course,' 2s.; Macmillan's 'French Course'; Chardenal's 'French Course,' Collins; edition of 'La Jeune Sibérienne,' by Hughes (Juxtalinear translation, post free, 1s. 6d.).

SCIENCE.—As most will study this under a master, no attempt will be made to advise a text-book; all science should be practical.

The above books will afford a choice for Pupil Teachers, and will be found sufficient for Scholarship as well. Let us close this part of our article by repeating the advice on the way to study:—*Thoroughly master the minimum of work appointed by the Code, and in addition study as deeply as possible some one favourite subject.*

Any Pupil Teachers who are in difficulty about drawing up a Time-table may have advice given them, if they will make an attempt at drawing up a Time-table showing the time devoted to each subject, and will forward it to this office addressed 'Joseph Hughes & Co.,' and marked outside 'Pupil Teachers' Course,' with a concise statement of any particular circumstances, such as attendance at Science and Art Classes, &c., and enclosing a stamped directed envelope for its return.

Work for November.

Reading and Recitation.—Juniors. Prepare Life of Keats.
Seniors. Life of Shakespeare, Introduction to Richard II.

English Grammar.—1st year. Subject and predicate of a sentence [note that every word in the sentence is a part either of the subject or predicate]: practise dividing sentences into these two parts.

2nd year. Co-ordinate sentences: practise analysis; Latin prefixes.

3rd year. Greek prefixes; analysis and parsing.

4th year. Outline of literature to 1066.

Arithmetic and Mathematics.—1st year boys. Definitions in vulgar fractions: G.C.M. and L.C.M.; Euclid definitions and axioms, prop. 1–3; Algebra, as far as addition.

1st year girls. Simple practice, with Euclid and Algebra as above, if possible.

2nd year boys. Theory of ratio; Euclid and Algebra as above.

2nd year girls. Same as 1st year boys.

3rd year boys. Square root; Euclid I., 27–31; Algebra to end of addition and subtraction; mensuration of parallelograms.

3rd year girls. Definitions; addition and subtraction of decimals; begin Euclid and Algebra, if possible.

4th year boys. Cube root; Euclid II., 1–3; circumference of circle; Algebraical factors.

4th year girls. Theory of proportion; Euclid and Algeba, *see* 3rd year.

Geography.—Physical geography of England and Scotland, and physical map of England from memory.

History.—Early Britain; Cæsar's visits; Roman occupation.

SCHOLARSHIP QUESTIONS.

PENMANSHIP.

Large Hand:—'*Demonstration.*'

Small Hand:—'*How oft the sight of means to do ill deeds makes ill deeds done!*'

ENGLISH GRAMMAR.

1. Paraphrase:—

> 'Thus, all in vain exhorted and reproved
> She perished; and, as for a wilful crime
> By the just gods whom no weak pity moved,
> Was doomed to wear out her appointed time,
> Apart from happy ghosts, that gather flowers
> Of blissful quiet 'mid unfading bowers.'
> Wordsworth's '*Laodamia.*'

2. Analyse the following and parse words in italics:—

> 'In the death-chamber for a moment *Death*,
> *Shamed* by the presence of *that living* Might,
> Blushed to annihilation, and the breath
> Revisited those lips, and *life's* pale light
> Flashed through those limbs, *so late her* dear *delight*.'
> Shelley's '*Adonais.*'

3. Give English words derived from the following roots:—Pendo, teneo, facio, video, bellum, dens, dies.

4. What are 'doublets'? Give examples.

5. Which of the following words are of foreign origin, and how do you recognise them:—Wall, twelve, physic, deposition, reprove, andante, and, manhood, century, begin.

Arithmetic.—Theory Questions.

1. What is meant by 'Complementary Addition?' Which of the higher rules are simplified if Subtraction has been taught as Complementary Addition?

2. In beginning to teach Long Division, how would you graduate the divisors?

3. What are the advantages of the Metric System?

4. How was the Metre originally obtained? Give its length in inches. Show how the other measures in the Metric System are derived from the measure of length.

5. How can you tell by inspection whether a given fraction will reduce to a recurring or non-recurring decimal?

6. Explain the meaning of 'at par,' 'at a premium,' 'brokerage.'

Work examples in rules you feel weakest in.

Algebra.

1. Find the value of

$$\frac{a-1}{a+1}+\frac{(a-1)(a^2-1)}{(a+1)(a^2+1)}+\frac{(a-1)(a^2-1)(a^3-1)}{(a+1)(a^2+1)(a^3+1)}.$$

2. Solve the equations—

(i) $$\begin{cases} x^2+y^2-z^2=0. \\ x+y+z=12. \\ xy+xz+yz=47. \end{cases}$$

(ii) $$\begin{cases} x(2x+3y)=26. \\ y(2y+3x)=39. \end{cases}$$

(iii) $$\frac{x^2+2x+2}{x+1}+\frac{x^2+8x+20}{x+4}=\frac{x^2+4x+6}{x+2}+\frac{x^2+6x+12}{x+3}.$$

3. Extract the cube root of $8x^3-36x^2y+48x^2z+54xy^2+96xz^2-144yz^2+108y^2z-144xyz-27y^3+64z^3$.

4. If $s=\frac{1}{2}(m+n+p)$ show that

$$(s-m)(s-n)(s-p)=s^3-\frac{s}{2}(m^2+n^2+p^2)-mnp.$$

5. Find the G.C.M. and L.C.M. of

$2-x+7x^2-2x^3+6x^4$ and $9-6x+21^2-12x^3+6x^4$.

Euclid.

Revise the Propositions.

1. Of all the straight lines that can be drawn from a given point to a given line the perpendicular is the shortest, and of the others that which is nearer to the perpendicular is greater than one more remote.

2. Produce a given line so as to make the square on the whole line thus produced twice as great as the square on the given line.

3. In a right-angled triangle the straight line joining the middle point of the hypotenuse with the opposite angle is equal to half the hypotenuse.

4. BAC is the obtuse angle of a triangle, BA is produced to D, and CD is a perpendicular let fall on it from C, similarly CA is produced to E, and BE is a perpendicular let fall on it from B. Prove that the rectangle BA, AD equals the rectangle CA, AE.

Geography.

1. Draw a map of that part of Africa south of the Equator which belongs to Britain, specially indicating places of recent historic interest.

2. Give an account of the distribution of rain over the continent of Africa, and show the dependence of the vegetable products upon this.

3. In what ways have the physical features of the British Islands helped to determine the people settled in the different parts of them?

4. Say what you know of the following:—Bassein, Rosario, Dunkirk, Limerick, Kars, Belgrade, Elbœuf, Sedan, Bonn, Brindisi, The Hague, Charlestown, New York, and Perth.

5. Compare the British Possessions within the Tropic with those in the Temperate Zones.

6. Write a short account of Uganda.

History.

1. Give an account of British industries in the reign of Charles I.

2. What was the 'Grand Remonstrance'? Give an account of the men who drew it up.

3. Draw a sketch map of England, marking the sites of the more important engagements in the Civil War of Charles I.

4. Give an account of the principal events in Irish history between 1640 and 1690.

5. Sketch the history of Great Britain's connection with slavery and the slave trade from 1783 onwards.

6. Point out those events in the reign of James II. that led most directly to the Revolution.

School Management.

1. What is the difference between a Dictation Lesson and a Dictation Test? How would you conduct a Dictation Lesson?

2. Draw up a short series of Object Lessons calculated to train children in making comparison, and write notes on one subject you name.

3. What are the objects of Mental Arithmetic? Give twelve exercises suitable for children who have been ten months in Standard IV.

4. What are the advantages of simultaneous and individual reading respectively.

Domestic Economy.

1. What is about the average weight of a hen's egg? What foodstuffs does it contain? Why is it called a 'perfect food,' and how many eggs would afford sufficient food for a man per day supposing he ate nothing else?

2. Describe the different kinds of saucepans you know? What are their respective advantages?

3. Arrange a week's dinners for a working man, with wife and four children, whose income is 35s. a week.

4. How would you disinfect a sick-room after a fever?

COMING MEN.

XII.—MR. WM. SINCLAIR,

President of the Sheffield and District Teachers' Association.

It is scarcely within the range of possibility that any of our readers who take any interest whatever in matters pertaining to the N.U.T. can have forgotten the man who appears as the subject of this sketch. To the younger members of our profession, especially, does the name at the head of this column appeal for attention. When it was decreed that we should interview Mr. Sinclair, we were at once in accord with the judgment which had prompted his inclusion in this series of articles. Our journey to Sheffield was made with the amply realised anticipation that we should have a conversation and exchange of opinions with one whose knowledge of the requirements of national education, and whose grasp of ready means to remedy existing defects, are of a striking nature—the result of careful research.

We found Mr. Sinclair comfortably established in a new home, and the time we spent with him was by no means bereft of intellectual gain.

Mr. Sinclair was born in the far north of Great Britain at Holm, in the Orkney Islands. Here, at the Parish School, he received his education as a scholar, and later, though not in the same school, served his apprenticeship as a Pupil Teacher. From thence he proceeded to the Training College at Moray House, Edinburgh, where he spent the years 1883–4.

On leaving college he came still further south, entering the service of the Sheffield School Board as Assistant Master at the Grimesthorpe Board

School. Here he spent some five or six years and was then appointed Senior Assistant Master at the Lancasterian Board School. Last year he was promoted to the headship of his present school, the Netherthorpe Board School, Sheffield.

Mr. Sinclair first came into prominence as an advocate for better conditions of service for the Assistant Teacher. The Sheffield Assistant Teachers' Association, the oldest organisation of its kind in the country, found in him an enthusiastic member and an ardent supporter. He took office as a member of its committee at a time when the energy and vigour which had characterised its inauguration were all but expended, and by his keen business perception and excellent methods of organisation, he raised it to its present position of being the largest associated body of Assistant Teachers in the provinces. In 1888 he was elected President of this Association, and it is a striking demonstration of the confidence reposed in him by his colleagues, that he occupied the Presidential chair for four years. The success which attended the Association during his term of office was largely due to his efforts, and the proud position which the Sheffield Assistant Teachers now occupy, always reminds one of the labours of Mr. Sinclair.

During his connection with this Association he expressed the idea that it was advisable to establish some means of communication and some plan for concerted action with other kindred organisations. His conception of such action was realised when he was invited, along with other prominent Assistant Teachers, to address the Bradford N.U.T. Association in 1891. Here he expounded his proposal to those who were asked to support his remarks, and the result, as every Assistant Teacher knows, was the first gathering of the representatives of the Assistant Teachers' Associations at Sheffield in January 1892.

The great amount of labour which that Conference involved, the arrangement for the reception of the delegates, the drafting of a suitable agenda and the organisation of the whole concern fell mainly on the shoulders of Mr. Sinclair.

When the Conference met, it unanimously voted him to the chair, and thus conferred upon him the distinction of presiding over the first Conference of Assistant Teachers ever held. His conduct in the chair, his sound advice and keen perception, were admirable and extremely valuable at that time, when the policy of the Assistant Teacher stood sorely in need of careful moulding and skilful engineering.

At that Conference, in response to the unanimously expressed wish of the assembled representatives, he decided to seek a position on the N.U.T. Executive. His selection was most popular. The Sheffield and District Teachers' Association which met upon the same day enthusiastically endorsed the wish of the Conference and at once nominated him. His efforts were successful, and at the Leeds Conference of the N.U.T. he was declared elected.

His connection with the National Union of Teachers has been, and is, of the same creditable character as that with other bodies. Joining the Union soon after leaving college, his work in Sheffield brought him into local prominence, and it was not long before he was elected to the Committee of the Sheffield Association. His election to the Executive was amply justified by his labours. Ever ready to assist any movement which had for its object the benefit of the Teacher, he still kept as his guide the belief that any improvement in the condition of the Teacher must be justified by a corresponding improvement in education. Last year he was elected Vice-President of the Sheffield Association, and he now occupies the Presidential chair. His address to this, the largest Association in the provinces, on the occasion of his induction to the chair, was an able exposition of his views upon the broad question of national education, and as the opinions he then expressed are characteristic of his labours, they are worthy of expression here. Briefly he laid down:—

'That improvement in the teaching profession must be justified by corresponding improvement in education.

'That good education can only be secured by means of good Teachers.

'That a regular supply of good Teachers can only be secured by making the profession reasonably attractive, and that as the teaching profession cannot by any expansion of terms be defined as reasonably attractive, the interests of education imperatively demand that it should be made so.'

Such is the platform upon which Mr. Sinclair bases his efforts for the improvement of the Teacher's position. Shortly after his election to the Executive, he contributed an excellent article to the Westminster Review upon the question of the Annual Examination, which he regards as a most iniquitous institution.

His policy on the Executive was that of bringing under the notice of the Executive such questions as needed attention, and endeavouring to secure that the public should be educated upon such questions by the ablest leaders of the Union. Particularly in the case of action, taken on behalf of the Assistant Teacher, was the utility of this policy obvious. The Liverpool Conference bore striking testimony to the plan adopted by the Assistants' representatives. Mr. Yoxall's paper on the 'Position and Pay of the Assistant' and the names of the movers of such resolutions affecting Assistant Teachers as were placed upon the agenda by the Executive were the results of the diplomatic policy already referred to. On the delicate and harassing question of Corporal Punishment, Mr. Sinclair was one of the first to suggest that a solution lay in the principle of delegation, which was adopted by the Executive as the most likely to be secured.

Superannuation, too, has claimed much consideration on his part, his best known action upon this subject being the result of his determination to secure equality of treatment for *all* Teachers whenever a scheme should be adopted.

We discussed the various aspects of educational matters, and not a few remarks were dropped by Mr. Sinclair, which we regard as being worthy of consideration by those who are in authority.

Commenting on the insecurity of the Teacher's position, Mr. Sinclair remarked:—

'The question of tenure is bound up with that of pensions, and it is a matter towards the settlement of which the entire resources of the Union must, if necessary, be devoted. But I am extremely anxious to see what is to be done in the case of those Teachers whose schools, for reasons beyond their control, are closed by the Department. The impera-

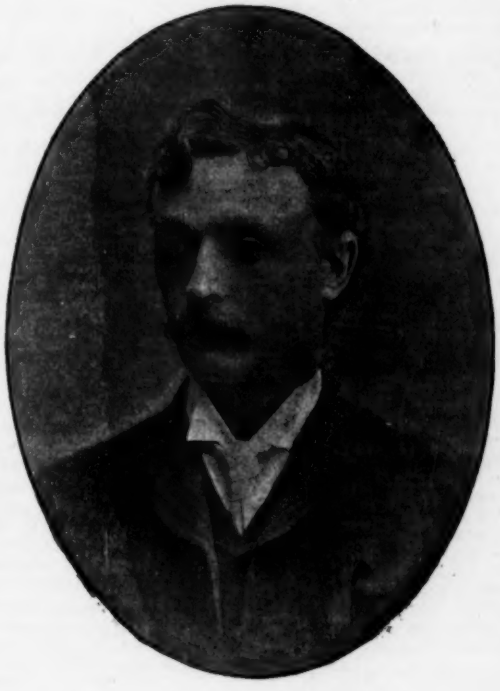
tive duty of the State to these Teachers is obvious. The Union, too, must be prepared to see that such of its members as are placed in this position shall not be allowed to fear the workhouse. It is the duty of the Department to provide reduced pensions for Teachers thus situated, but failing such provision, the Sustentation Fund of the Union should be at their disposal.'

Dealing broadly with national education, Mr. Sinclair favoured us with the following observations:—

'Looking forward to the time when the great social questions, which are now crying out for attention, will come up for solution, I cannot fail to be impressed with the serious responsibility resting upon those entrusted with the education of the young.

'This impression forces all the more strongly upon me the conclusion that it is a grave error to discuss the professional concerns of the Teacher apart from the requirements of education. Schools, Managers, School Boards, Inspectors, and the Department all exist for the sake of the child, but all this machinery is unavailing unless it accomplishes its purpose of bringing into contact the Teacher and his pupil.

The Teacher is the mainspring of education, and therefore, any considerations which have for their aim educational advancement, must necessarily embrace the position of the Teacher.'



Wm Sinclair

These remarks led to a conversation upon the subject of training Teachers.

Mr. Sinclair thinks that more care should be taken in the selection of Pupil Teachers, and he has drafted a scheme for their instruction which will doubtless be further heard of. He believes in the method of tuition at Pupil Teacher centres, but his 'half-time' system is unique. He would have the Pupil Teacher in his class for a period of two years, after which he should spend two years in school in order to obtain practical training, and afterwards proceed to training college to qualify for his diploma.

We ventured a remark upon the employment of lady Teachers in boys' schools.

'That,' said Mr. Sinclair, 'may be met, I think, by demanding that where a lady is called upon to perform the same services as those required from members of the opposite sex, the same salary should be paid as is given to the male Teacher.'

Rate aid to Voluntary Schools is, in Mr. Sinclair's opinion, a matter beyond the pale of the consideration of the N.U.T. It is a managers' question, and also, being of a political nature, should be avoided by Teachers.

'And now,' we said, 'there is one question we should like to ask. During the period that you were actively engaged in endeavouring to improve the condition of the Assistant Teacher, it was part of your creed that the Assistant was hampered by obnoxious regulations, bereft of professional recognition, and generally in a position of undeserving subordination. How do you view this question after your experience as a Head Teacher?'

'I am glad,' was the reply, 'that you have asked that question. It gives me an opportunity of stating that my views have undergone no change. The organisation of my school is carried out upon principles laid down at a consultation of the staff. In fact, if I may put it in this way, I am the only Assistant in my school. The Class Masters are responsible for the tuition of their pupils, and so long as able and efficient Teachers are supplied I have yet to realise the inadvisability of investing them with responsibility. They do the work: I endeavour to assist by securing effective organisation, by strengthening their hands in the matter of discipline, and by aiding wherever weakness in any subject is displayed.

'Any question of importance which affects the school is, as a rule, settled according to the expressed opinions of the majority of the staff after it has been carefully considered.

'In this way each Teacher is at liberty to express his opinion, and to profit by mutual interchange, and the school is the better for it.'

'One more question—

'Do you find your position as head of the school strengthened by the present prohibitive corporal punishment regulations?'

'Emphatically no,' was the reply; 'I am convinced that it is materially weakened. Potentially—reserve power is a most important factor in discipline, and the fact that I am compelled to interfere in comparatively trivial matters renders my influence for good less effective when grave moral offences have to be dealt with.'

Such were the expressions let fall by one who has won for himself a place in the hearts of his fellows.

One must visit Sheffield, go to a meeting of the influential Association, and rub up against the Teachers there to realise the extent of the respect and esteem in which Mr. Sinclair is held.

In his home tokens of the feelings of his colleagues towards him display themselves. In his school the hearty tone and sympathetic co-operation which characterise the staff speak volumes. In the neighbourhood of Sheffield every Teacher gratifies you with an expression of admiration for the Association's President. On the Executive of the N.U.T. and throughout the country Mr. Sinclair has made many warm friends by his devotion to self-sacrificing labour. He has not yet reached that period of life when it is necessary to retire from active service, and we look forward with satisfactory anticipation to his reappearance in the arena. His reputation at Russell Square is such as will surely produce him a hearty welcome when he returns, and, with the best interests of the Union in view, we can wish for no better consummation.

EXERCISES IN FRENCH FOR CERTIFICATE EXAMINATION.

I.—Notes on French-English Sight-Tests.

The following are notes on, and translations of, the italicised passages in the French-English sight-tests set in the October number of the PRACTICAL TEACHER, to which the student is recommended to refer for the context:—

I.—*First Year Students.*

A.—(i.) *Ils ne veulent souffrir que les arts qui servent aux véritables nécessités des hommes* = They will only allow those arts which supply the real requirements of men.

Note (*a*) that *vouloir* must translate our *will* when futurity is not implied; (*b*) 'ils se servent *de* thé' = they *use* tea.

La plupart des hommes = the majority of men.

Note that this word denoting quantity takes the full form of the partitive article, not *de* simply.

Ils ne laissent pas d'exercer les arts = they do not neglect to exercise the arts.

Note: If *de* were omitted here the meaning would be: they do not *allow* the arts *to be exercised.*

(ii.) *Elles apprêtent à manger* = they prepare the meals.

On ne vit en ce pays que de fruits = In this country they live on fruit only.

Note: vivre de = to live or subsist on.

Les unes, les autres = some, others; not *the* others.

Dans un ordre et une propreté admirables = In admirable order and neatness.

Note (*a*) that the adjective *admirables* is plural because it qualifies *two* singular nouns; (*b*) that the indefinite article before abstract nouns in French should not be translated in English.

(iii.) *Dans une riante soirée de mai* = On a smiling May evening.

Note: Present participles are indeclinable; but when used simply as adjectives they are declinable; the usual place of these participial adjectives is *after* the noun they qualify. Then why does it precede *soirée* here? Because *riante* is the quality of *all* May evenings—May in France being one of the most delightful months.

D'où il faisait admirer la beauté de la nature = Whence he called attention (lit. *caused to be admired*) to the beauty of nature.

Note: faire is followed by an *active* infinitive with a *passive* meaning.

Le soleil couchant = the setting sun.

Note that here the participial adjective follows the noun because the sun is not always setting; the rising sun = *le soleil levant.*

Des deux côtés = On both sides.

Aucune brebis ne s'en approchait = No sheep approached it.

Note: We have *en* for *it* here because *to approach* is *s'approcher de.* Words denoting *nearness* in French take *de.*

(iv.) *Assieds-toi* = Sit down.

Note: toi is the accusative reflexive pronoun. The 2nd person singular is used between familiars.

Ton front est tout en nage = Your forehead is dripping with perspiration.

Il faut te ménager des forces pour l'avenir = You must economise your strength for the future.

Note: (*a*) *forces*, plur., = strength; (*b*) *futur* is only a grammatical term; *e.g.*, *le temps futur* = future tense.

(v.) *Une des plus fâcheuses pertes qui pût arriver* = One of the most disastrous losses that could happen.

Note: Why is *pût* subjunctive? Because it occurs in an adjective sentence qualifying a noun which is qualified by an adjective in the superlative degree.

Aussi désolé que nous le sommes ici = As distressed as we are.

Note: le, the neuter pronoun, which is not translated in English, refers to a fact or state of things, and not to a substantive. Our word '*so*' often translates it; *e.g.*, 'Etes-vous content de sa conduite?' 'Oui, je *le* suis.' 'Are you pleased with his behaviour?' 'Yes, I am' (so).

Le roi en a été affligé, comme on doit l'être = The king has been distressed at it, as one must be.

Note: Here again the *le* before *être* is the neuter pronoun, and it stands for *être affligé*, not for a noun.

Le plus honnête homme du monde = the most honourable man in the world.

Note: Our *in* after a superlative adjective is translated by *de.*

M. de Condon pensa s'évanouir = M. de Condon thought he was going to faint.

(vi.) *À Versailles, ville qu'habitait ma mère* = At V., the town where my mother lived.

Note (*a*) the absence of the definite article before *ville* because it is in apposition with Versailles; (*b*) the inversion of the verb *habitait* and its nominative *mère* so as to bring the objective relative *qu'* close to the verb.

Qui en faisaient alors le service = Which at that time were running (as we speak of trains).

De son côté = For his part.

Une grosse pièce de deux sous = A big penny.

II.—*Second Year Students.*

(i.) *Une imprudence* = An *act of* imprudence.

Le feu venait de prendre la goélette = The fire had just caught the schooner.

Tout ce que l'énergie a de plus actif = All that is most active in human energy.

Note: Why *de* before *plus actif*? Because *actif* is an adjective following and qualifying an indefinite pronoun, *Tout ce que.* Cf. *quelque chose de merveilleux* = something wonderful.

L'horizon s'était obscurci = the horizon had become hidden.

Note: Why *était*? Remember the rule for reflexive verbs to conjugate with *être.*

(ii.) *Comme il avait une bonne santé* = As he enjoyed good health.

Il pouvait pourvoir à celle des siens = He was able to provide for that (*i.e.* the subsistence) of his family.

Note: Do not confound *pouvoir* and *pourvoir*. Compare this use of *siens* with the phrase '*Ne serez-vous pas des nôtres?*' 'Won't you join us?' or 'Won't you make one of us?'

Pièce à pièce = piece by piece.

Quand il se fut ainsi dépouillé = When he had thus stripped himself.

(iii.) *Le travail se faisait sans bruit* = The work was done noiselessly.

Les *figures* = the faces.

(iv.) *Il crut y apercevoir debout une forme humaine* = He believed he perceived a human form standing there.

Note: No one word in French for our *stand; se tenir debout* is the French equivalent, but the adverb *debout* translates *standing*.

Qui s'était esquissée le soir = Which the evening before *had* sketched itself.

Il se tenait sur la barque = He stood on the barque.

Note that here *debout* is not expressed.

Plongeant du regard sur la côte = Looking most intently at the coast.

(v.) *C'était comme s'il eût dit* = It was as if he had said.

Note: Si = *if* can only be followed by *one* tense of the subjunctive, viz., the pluperfect. This in an example.

Roide mort = stiff in death.

Sans faire nulle attention sur lui = Without paying any attention to him.

Note the double negative *sans nulle*.

(vi.) *Il hésitait dans le parti qu'il avait à prendre* = He hesitated as to what course he must adopt.

Note: avoir à, like our *have to*, is used to denote *obligation*.

Peu habitué à ce qu'on le fasse attendre = Unaccustomed to people keeping him waiting.

La lenteur que met Duroc à le rejoindre = The slowness which Duroc exercised in joining him.

Note: Great care must be exercised in this construction to avoid making *que nominative* to the verb. *Que* cannot be nominative.

II.—Translation of English-French Sight-Tests.

The following are translations of, and notes on, the passages set for translation into French in the October number of the Practical Teacher :—

I.—*First Year Students.*

(i.) Il y a plusieurs mines d'or et d'argent dans ce beau pays ; mais les habitants, simples et heureux dans leur simplicité, ne daignent pas compter l'or et l'argent parmi leurs richesses ; ils n'estiment que ce qui sert véritablement aux besoins des hommes.

(ii.) À l'heure qu'il est, je possède deux maisons à Paris, et j'ai cédé ma fabrique de papier à mons fils, à qui j'ai enseigné de bonne heure le bon goût du travail et de la persévérance. Faites comme *moi*, l'ami (or *mon ami*) et vous deviendrez riche comme *moi*.

Note that a personal pronoun used with the verb understood requires the *disjunctive* form ; hence 'comme *moi*.'

(iii.) Souvent les religieux remplissent *eux-mêmes* cet office *pour* donner aux voyageurs des secours temporels et spirituels ; ils volent à leur aide toutes les fois que le marronnier ne peut seul suffire à les sauver; ils les conduisent, les soutiennent, quelquefois même les rapportent sur *les* épaules jusque dans le couvent.

Note (*a*) the difference between *themselves*, etc., when *reflexive* and when *emphatic*, as here ; (*b*) the definite article instead of the possessive adjective is used with names of *parts of the body* unless the possessive pronoun in English is emphatic.

(iv.) L'usage des liqueurs fortes est extrêmement dangereux dans ces moments-là, et cause souvent la perte des voyageurs; ils *croient se réchauffer* en buvant de l'eau-de-vie, et cette boisson leur donne en effet pour quelques moments de la chaleur et de l'activité; mais cette tension forcée est bientôt *suivie* d'une atonie, et d'un épuisement qui devient absolument sans remède.

Note that when in English the subordinate sentence depending on *croire* has the same subject as *croire* itself, the subordinate clause is translated by the infinitive.

(v.) Vous qui, *en vous couchant le soir*, trouvez un lit bien doux ; qui, en vous réveillant le matin, trouvez votre repas tout préparé ; vous ne *vous doutez* pas que tout près de vous, là-haut peut-être, au dernier étage de la maison que vous habitez, une famille indigente *manque de* pain et de feu.

Note: (*a*) Remember to make the reflexive pronoun agree in person with the nominative ; thus 'en *vous* couchant,' not 'en *se* couchant.' (*b*) To suspect = *se douter*. (*c*) *Manquer*, trans., = to miss or lose; *manquer de* = to want for, to lack.

(vi.) Jamais Epaminondas *n'avait-il déployé* plus de talent que dans cette circonstance. Il suivit dans son ordre de bataille les principes qui lui avaient procuré la victoire de Leuctres. Une de ses ailes, formée en colonne, tomba sur la phalange lacédémonienne, qu'elle n'aurait peut-être jamais enfoncée, s'il *n'était venu* lui-même fortifer ses troupes par son exemple, et par un corps d'élite dont il était suivi.

Note (*a*) the inverted construction used when *jamais* (emphatic) begins a sentence; and that the past-anterior *eut déployé* could have been used here. (*b*) After *si* = *if* the pluperfect subjunctive may be used (and no other tense of the subjunctive); thus *s'il ne fût venu* would be correct. (*c*) The infinitive of *purpose* following *venir* takes no preposition.

II.—*Second Year Students.*

(i.) Après avoir mangé de très-bon appétit et avoir pris une *demi-tasse* de café, qu'il prétendit être meilleur que celui qu'on lui servait habituellement aux Tuileries, il appelle le garçon, lui demande la carte, et se lève, en disant à Duroc: 'Payez, et rentrons; il est temps.' Puis, se posant sur le seuil de la porte du café, *les mains croisées* sur le dos, il se met à siffler entre les dents un récitatif italien.

Note: (*a*) *demi* and *nû* are invariable *before*, and variable *after* the words they qualify, *e.g.*, 'une heure et *demie*;' *nû-pieds, pieds-nûs*. (*b*) No preposition is used in French to translate our *with* in such descriptive phrases as *les mains croisées*.

(ii.) Ayant dit ces mots, elle se tut un peu de temps (quelques moments); ensuite elle reprit:—'Quand je perdis votre père, ce fut une douleur que je crus sans consolation ; cependant vous me restiez; mais je ne sentais qu'une chose alors. Depuis j'ai pensé que, *s'il vivait, et qu'il nous vît* dans cette détresse, son âme se briserait, et j'ai reconnu que Dieu avait été bon *envers* lui.

Note that in French the same conjunction (except *que*) is seldom repeated, but *que* is used instead; but *que* = *if* always requires the subjunctive, whereas *si* = *if* never takes the subjunctive *except the pluperfect tense*.

(iii.) Tout à coup, une affreuse tempête *vint à s'élever ;* les flots amoncelés battaient avec fracas les rochers et la plage; de toutes parts, des navires que l'on avait *vus* voguer tout à l'heure paisiblement, tiraient le canon de détresse; l'un d'eux, celui qui était le plus rapproché *du* port, semblait prêt à s'abîmer sous des vagues, qui, de leur sommet, le rejetaient dans un gouffre effrayant.

Note: venir followed by an infinitive preceded by à = to happen to. *Il vient à réussir* = he happens to succeed ; *il vient de réussir* = he has just succeeded; *il vient réussir* = he comes to succeed, or he comes and succeeds.

(iv.) Avant *d'*aller annoncer à sa mère *son* heureuse matinée, Pierre rentra un instant dans sa barque pour examiner les réparations qu'il aurait à faire à ses filets. Mais quelle ne fut pas sa surprise lorsqu'en les soulevant il aperçut à ses pieds une bourse qui renfermait plus de deux mille francs en or! Sa première pensée fut *de* croire que c'était un oubli de l'inconnu, et, courant sur-le-champ après lui, il l'aperçut *qui causait* au milieu d'un groupe d'étrangers.

Note: (*a*) avant *de*, not *avant*, before an infinitive ; (*b*) an infinitive in apposition requires *de* (*de croire*) ; (*c*) observe the translation of the present participle *chatting*, used descriptively, by the relative clause *qui causait*. Cf. 'Here he is walking with his father' = *le voici qui marche avec son père*.

(v.) Un pêcheur, à qui ce bateau appartenait, ramassa l'assiette, et la rapporta au gouverneur. Celui-ci, étonné, demanda au pêcheur: 'Avez-vous lu ce qui est écrit sur cette assiette, et quelqu'un l'a-t-il *vue* entre vos mains?' 'Je ne *sais* pas lire' répondit le pêcheur; je *viens de la trouver;* personne ne l'a *vue*.' Ce paysan fut retenu *jusqu'à ce que* le gouverneur fut bien informé qu'il n'avait jamais lu, et que l'assiette n'avait été vue de personne. 'Allez,' lui dit-il, vous êtes bien heureux de ne savoir pas lire (*or* de ne pas savoir lire).

Note (*a*) carefully the italicised words; (*b*) *jusqu'à* is a preposition = until ; the conjunction *until* = *jusqu'à ce que ;* (*c*) to be able *mentally* is expressed by *savoir ;* to be able *physically* by *pouvoir*, *e.g.*, *je sais lire, je peux lever cette pierre*.

(vi.) 'M. le Maréchal, lisez, je vous prie, ce petit madrigal, et voyez si vous *en* avez vu un aussi impertinent, parce qu'on sait que depuis peu j'aime les vers, on m'*en* apporte de toutes les façons.' Le Maréchal, après avoir lu, dit au roi: 'Sire, votre majesté juge divinement bien de toutes les choses; il est vrai que voilà le plus sot et le plus ridicule madrigal que *j'aie jamais lu*.' Le roi se mit à rire, et lui dit: 'N'est-il pas vrai que celui qui l'a fait est bien fat?' 'Sire, il n'y a pas moyen (or *il est impossible*) de lui donner un autre nom.'

Note (*a*) that *en* is required before the verb when it is followed by an adjective qualifying the noun object *understood ;* (*b*) that the adjective sentence qualifying a noun, which is qualified by an adjective *in the superlative degree*, requires the subjunctive.

A.—French-English Sight-Tests for December.

In the December number of the Practical Teacher the italicised portions will be translated and grammatical explanations and hints given bearing on these passages.

I.—*First Year Students.*

(i.) Le jour favorisa les efforts du duc de Trévise; il se rendit maître du feu. Les incendiaires se tinrent cachés. On doutait de leur existence. Enfin, des ordres sévères étant donnés, l'ordre rétabli, l'inquiétude suspendue, *chacun alla s'emparer d'une maison* commode ou d'un palais somptueux, pensant y trouver un bien-être acheté par de si longues et de si excessives privations.

(ii.) Madame de Sésanne, l'une des plus aimables et des plus jolies femmes de Paris, voulut faire avec moi cette promenade mystérieuse; j'en craignait l'effet sur une imagination de vingt ans, et je fis d'abord quelques objections que sa mère appuya; mais rien ne put *la décider à renoncer à ce projet.* Le lendemain à midi, ma jeune compagne vint me prendre dans sa voiture et les poches pleines de bougies, *comme si nous eussions dû rester* quinze jours sous terre, nous nous acheminâmes vers la barrière d'Enfer, en remarquant ce singulier rapport entre le nom de cette porte et le lieu que nous *allions visiter.*

(iii.) Mais le moulin *n'est pas achevé de bâtir*, le marais n'est pas desséché, le chemin est à peine tracé, et déjà l'argent me manque. *Que faire?* mon fermier a besoin de ce chemin; et ce moulin, mes paysans *ne peuvent s'en passer.* Cependant je puis à peine remplir mes engagements; *il me faudra même de l'économie* pour achever le reste de l'année . . . . Quoi! encore de l'économie, de la gêne, des privations! Est-il possible qu' avec 80,000 *livres de rente, on ne puisse pas se tirer d'affaire.*

(iv.) Enfin, quand il observait la grandeur et la magnificence de tant de palais, les richesses dont ils étaient ornés; le luxe des équipages; cette multitude d'esclaves et de serviteurs empressés, et l'éclat de ces spectacles magnifiques, le fracas de ces festins, de ces fêtes, de ces joies somptueuses, qui sans cesse y retentissaient, il se croyait transporté au milieu d'une ville de rois, dans un rendez-vous de souverains, *venus avec leurs usages*, leurs mœurs et leur suite, de toutes les parties du monde.

II.—*Second Year Students.*

(i.) Au sein des rochers les plus escarpés, au travers de glaces éternelles, au milieu des neiges qui effacent toutes les traces et n'offrent plus qu'un immense désert, et par des chemins où le pied de l'homme n'a jamais été empreint, les Français montrent un indicible courage; gravissant péniblement, n'osant prendre le temps de respirer, parce que la colonne *en eût été arrêtée;* près de succomber sous le poids de leurs armes, ils s'excitent les uns les autres par des chants guerriers.

(ii.) Je rentrai dans ce même bureau, curieux de savoir quel pouvait être le motif de la fureur concentrée d'un homme que j'avais laissé assis sur des malles, pestant contre le conducteur, et prétendant *le rendre responsable* de tous les malheurs qui pouvaient résulter pour lui d'un retard de cinq minutes. *J'avais peine à me rendre compte des angoisses* qu'il paraissait éprouver; mais tout fut éclairci par l'arrivée de quatre racors (bailiff's officers), lesquels, munis d'une contrainte en bonne forme, le prièrent honnêtement de les suivre. En vain prouva-t-il qu'il avait payé sa place à la diligence; on lui démontra que la sienne était à Sainte-Pélagie, où ses créanciers l'attendaient.

(iii.) Des inscriptions, placées sur des piliers de pierres de liais (*limestone*), indiquent à quels quartiers de Paris ces restes ont appartenu. Là toutes les distinctions de sexe, de fortune, de rang, *ont achevé de disparaître.* Le riche dépouillé de son mausolée de marbre, le pauvre sorti un peu plus tôt de son cercueil de sapin, confondent ici leurs dernières dépouilles: pour eux, cette fois, l'égalité commence. Que de grandes pensées enfantent de pareilles images! L'auteur du 'Génie du Christianisme' est digne d'en être l'interprète; 'L'âme entière,' dit-il, 'frémit en contemplant tant de néant (*nothingness*) et tant de grandeur: lorsqu'on cherche une expression assez magnifique pour peindre *ce qu'il y a de plus élevé*, l'autre moitié de l'objet sollicite le terme le plus bas pour exprimer ce qu'il y a de plus vil: tout annonce qu'on est là dans l'Empire des Ruines.'

(iv.) Je me lève de bonne heure aujourd'hui, je me porte bien; *que de choses je vais faire dans ma journée!* L'imprimeur attend de moi demain matière d'une *feuille d'impression;* commençons. *Mais* j'ai du temps; *il fait beau;* un tour de promenade m'a été ordonné par mon médecin; un ami a besoin de moi; une connaissance (*acquaintance*) m'arrête; je me souviens d'une affaire indispensable, d'une visite que je ne puis négliger; il faut absolument que j'aille savoir si mon agent de change (*stock-broker*) est revenu de la campagne. Quoi, déjà l'heure du dîner! ensuite il faut digérer; après cela les idées ne sont pas bien nettes; je prends un livre, puis un autre: enfin *m'y voilà;* ma tête se calme, mon imagination se rassied; je prends ma plume, mais ma pendule sonne . . . . onze heures? minuit! Demandez-moi *ce qu'est devenue ma journée.*

B.—English-French Sight-Tests for December.

Translations, with explanatory notes, will be given of these passages in the December number of the Practical Teacher.

I.—*First Year Students.*

(i.) Some months later this unfortunate prince, at the solicitation of Queen Isabelle, granted him in marriage Princess Catherine, her daughter, with the promise that after her death, he should join that crown to England's, and thus should be (*se trouver*) one of the most powerful monarchs in the world.

(ii.) The son of Henry V. was but quite a child when he was proclaimed King of France and England, under the name of Henry VI.; but, as has often been seen (*use reflexive verb*), this child, who seemed called to so high a destiny, had on the contrary only the most wretched and unfortunate life.

(iii.) During this bloody quarrel, the unhappy Henry, now in the power of the friends of Lancaster, now in the hands of the Duke of York, was the wretched toy of the fate of arms; and although Richard still affected to treat him with respect, he was none the less on that account his prisoner.

(iv.) Clifford having asked the young fugitive (*fuyard*) what his name was, the poor child, all of a tremble, cast himself at his feet weeping, and confessed to him that he was one of the sons of Richard. 'If that is so,' immediately replied that fierce man, 'as thy father caused the death of mine, I will also kill thee and all thy brothers.' Saying these words, the pitiless Clifford drew his dagger, and plunged it completely into the heart of the child, who at once expired.

II.—*Second Year Students.*

(i.) These three wretches, to whom Richard had delivered (*remettre*) for that night the key of the prison of the young princes, found them lying (*couché*) on the same bed, and sound asleep in one another's arms. A prayer-book was open at their side; for, despite their youth, they had not forgotten that their mother had recommended them never to go to sleep without having prayed God to bless their sleep. They were so beautiful, and their look (*visage*) so peaceful, that Tyrrel and his accomplices, scoundrels as they were, could not help (*s'empêcher*) being touched by their innocence.

(ii.) Richard very soon heard of (*apprendre*) the landing (*débarquement*) of his enemy; and although he well knew that the English hated him mortally, he did not doubt that if he succeeded in conquering Richmond, no one would dare henceforth to dispute with him his crown. He therefore put himself on the march at the head of an army much more numerous than Tudor's, and the two adversaries were not long in (use *tarder*) finding themselves in the presence of each other, near a little town called Bosworth, not far from Leicester, when a battle appeared inevitable.

(iii.) At this epoch the English lords had lost much of the turbulent and warlike temper of their ancestors the Norman barons. The long quarrel of the Two Roses had extinguished or dispersed the greater part of the most illustrious families, and many of them had seen their castles demolished during the civil wars. On one side, the burgesses of the towns, called for the first time into the counsels of the kings by Simon de Montfort, and often consulted by the powerful Edward III., as I have had you observe, formed in the Parliaments an assembly respectable and distinct from that of the lords, to which was given the name of the House of Commons.

Correction of Incorrect Sentences, &c.

Exercises of the following kind are sometimes given in the certificate and other examinations. Second Year Students only need prepare themselves for this kind of test. Answers will be given next month.

Correct the following sentences, giving reasons for your corrections:—

(i.) (*a*) Mon frère, mon cousin, et moi, iront en la campagne la semaine suivante.

(*b*) L'un ou l'autre ont raison.

(*c*) Beaucoup de personnes croit cet histoire.

(*d*) Les colonnes du temple étaient en marbre très dures.

(*e*) Disez à vôtres amies de venir et de dîner avec mon frère et me cette soirée.

(*f*) Votre frère est plus grand que j'aie cru.

(*g*) Voilà les plus grands chevaux que j'ai vu.

(*h*) Voicî les montres qu'ils s'ont prêté l'un l'autre.

(ii.) Translate and explain the difference in the agreement of the past participles in the following sentences :—
(*a*) 'Nous nous sommes *assurés* de la vérité.'
(*b*) 'Nous nous sommes *assuré* des revenus.'
(*c*) 'Elle s'est arrachée de nos bras.'
(*d*) 'Elle s'est arraché les cheveux.'
(*e*) 'Voici les chaises que nous avons fait raccommoder.'
(*f*) 'Voici les chaises que nous avons faites.'

NEW PROBLEMS IN ARITHMETIC.

BY T. B. ELLERY, F.R.G.S.,
Vice-President National Union of Teachers.

2ND PAPER.

For introduction, *see* October No. of *The Practical Teacher*. For other remarks on the same subject I refer my readers to the *Girls' Mistress* for September 1st, in which appears the first of a series of papers on *Standard Problems for Girls, and How to Work them*. In passing let me say:—

1. Every exercise here given will suggest to the practical teacher many others of the same kind.
2. The blackboard should be freely used in the solution of these problems.

STANDARD 4.

A.

1. How many half-guineas are there in 1,890 crowns?

2. Take the difference between 860 half-crowns and 1,506 florins from a hundred guineas.

3. How many hats at 5s. 6d. each must be given in exchange for five-and-a-half dozen pairs of boots at 13s. 6d. a pair?

4. A farmer bought 320 sheep at two-and-a-half guineas each. He sold 7 score at £2 15s. 6d. each, and the remainder at £2 17s. 6d. each. What did he gain?

5. A farmer bought 30 cows and 24 pigs for £506. Two cows and one pig died, and he sold the remaining cows at £16 each, and the remaining pigs at £2 10s. each. What did he gain or lose on the whole transaction?

6. A gentleman divided £81 13s. 4d. among his foreman and 28 of his workpeople. The foreman received ten guineas. What did each of the workpeople receive, all sharing alike?

7. I buy coal at 15s. 9d. per ton and sell it at 1s. 1d. per cwt. What do I gain on the sale of 150 tons?

8. A father and son together earn four guineas a week, the father earning five times as much as the son. What does each earn in a quarter of a year? (1 year is 52 weeks.)

9. A grocer bought half-a-ton of sugar. One half of this he put up in two-pound parcels, and the remainder in four-pound parcels. Find the total number of parcels.

10. How many yards of cloth at 1s. 7d. a yard must I give in exchange for 6 dozen hats at 12s. 6d. each and 12 umbrellas at half-a-guinea each?

11. How many gallons does a cask hold which weighs 5 cwt. 3 qr. 4 lb. when full, and when empty $2\frac{3}{4}$ cwt., a gallon weighing ten lb.?

12. If a man's income is a penny every second of the day and night, what is his income from Tuesday morning at 5.30 until Friday at 8 P.M.?

13. A man bought a tricycle for 22 guineas and a bicycle for 20 guineas. He paid one-fourth of the bill at once and the remainder in twelve equal instalments (one each month). What did he pay each month?

14. A gentleman left four thousand guineas to be divided amongst the members of his family. Each of the three daughters received £350, and each of his two sons twice that sum. The widow received the remainder. Find the widow's share.

15. A tobacconist bought tobacco at 5s. 4d. per lb. and sold it at $5\frac{1}{2}$d. an ounce. Find his gain on the sale of $\frac{1}{4}$ cwt.

16. I buy coal by the hundredweight at 1s. $1\frac{1}{2}$d. per cwt. or by the ton at 19s. 6d. per ton. What shall I gain by buying 200 cwt. by the ton instead of by the cwt.?

17. I buy $2\frac{1}{2}$ cwt. of sugar for £1 9s. 2d., and sell one-half of the whole at $1\frac{3}{4}$d. per lb. and the rest at three-halfpence a lb. What do I gain?

18. For the first 25 weeks of the year a man earned £1 10s. 6d. a week, and for the rest of the year two guineas a week. His total living expenses for the year amounted to 78 guineas. What did he save? (1 year is 52 weeks.)

B.

19. I bought 200 pears at 10 for 4d., and 300 at 5 for 3d. I sold the whole at a penny each. Find my gain.

20. A farmer gave 12 cows and 8 sheep in exchange for 16 horses each worth £18 12s. 6d. Each cow was worth £23 6s. 4d. What was each sheep worth?

21. A draper bought 240 yards silk at 2s. 6d. a yard, 360 yards at 3s. 4d. a yard, and lastly 480 yards. His total bill amounted to £270. What did he pay for each of the 480 yards?

22. A wine and spirit merchant buys 80 gallons of brandy at £1 2s. 6d. per gallon, and he sells it at 4s. 6d. a bottle. Calculate his gain. (Reckon 6 bottles to the gallon.)

23. A man worked from 6.15 a.m. until 5.30 p.m. daily (except Sundays) with $1\frac{1}{2}$ hour rest for meals. He received 8d. per hour for each working hour. His weekly living expenses were £1 5s. 10d. What did he save in a month of 4 weeks?

24. A coal merchant bought 10 trucks of coal, each $9\frac{1}{2}$ tons, at 16s. per ton. He sold 48 tons at a guinea a ton and the rest at 19s. 6d. a ton. Find his gain.

25. I buy $3\frac{1}{2}$ gross of pencils at 7d. per dozen, and sell 18 dozen at 8d. per dozen, 10 dozen at $8\frac{1}{2}$d. per dozen, and the remainder at 9d. per dozen. Find my gain.

26. A man earns 5s. 6d. a day and his son one-half that sum. Find the total earnings for a month (6 days 1 week, 4 weeks 1 month), the father being absent from work one day and the son two days during that time.

27. A publican bought 50 gallons of whisky at 17s. a gallon and mixed with 10 gallons of water. At what price per gallon must he sell the mixture so as to gain 20 guineas on the whole?

28. A man earns a thousand guineas per year, and he spends £80 15s. $2\frac{1}{2}$d. every quarter of the year. What does he save daily? (365 days 1 year.)

29. A milkman sold 180 gallons of milk for £14 6s. Of this he sold 116 gallons at 1s. 6d. a gallon. At what price per gallon did he sell the remainder?

30. I have £85 5s. in a bag, made up of an equal number of half-sovereigns, half-crowns, florins, and shillings. How many of each were there?

31. A collection of £22 7s. 6d. was made up as follows: In crowns £1 5s., in half-crowns £2 5s., in florins £3 2s., in shillings £6 18s., in sixpences £8 2s. 6d., and the rest was in penny pieces. What was the total number of coins in the collection?

C.

32. £26 18s. 3d. was contained in a bag. Of this amount £6 10s. was in gold and the rest was made up of an equal number of half-crowns, florins, shillings, and threepenny pieces. Find the number of each silver coin. [Note. First deduct from the total sum the amount in gold.]

33. I employ a number of men, women, and children, the number of each being the same. Each man receives 5s. 10d. a day, each woman 2s. 10d., and each boy 1s. 3d., and I pay in wages £10 18s. 2d. daily. How many women do I employ?

34. £31 is contained in a bag. Of this amount £20 is in bank notes and £7 10s. in gold. The rest is made up of an equal number of sixpences, threepences, pennies, and halfpennies. How many of each silver coin? [See note to No. 32.]

35. 72½ tons of coal are bought at 13s. 6d. per ton, and sold for £52 11s. 3d. What is the gain per ton?

36. 16 lb. of sugar cost as much as 1 lb. of tea, and 4 lb. of tea cost as much as 6 lb. of coffee. Coffee is 1s. 4d. a lb. Find cost of 1 lb. of sugar. [Note. Find cost of 6 lb. of coffee. This gives cost of 4 lb. of tea.]

37. A man earns twice as much as his wife, and his wife twice as much as their son. Together they earn 70s. in a week of 6 days. What does the wife earn *in a day?* [Note. Son 1 share, wife 2 shares, man 4 shares.]

38. £36 12s. is divided among 8 men and 8 women, each man receiving twice the share of a woman. Find the share of a man.

39. What is the *least* amount I can *add* to £586 18s. 2½d. so that the sum may be exactly divisible by 39? [See note on last exercise in last month's Paper.]

40. Find the *nearest amount greater than* £309 16s. 4d. which is exactly divisible by 67. [See note to No. 39.]

NEW PROBLEMS.—ANSWERS.

A.	B.	C.
(1) 900 half-guineas.	(19) £1.	(32) 71 of each.
(2) £61 18s.	(20) £2 5s. 6d.	(33) 22 women.
(3) 162 hats.	(21) 7s. 6d.	(34) 80 of each.
(4) £66.	(22) £18.	(35) 1s.
(5) Lost 10s.	(23) £2 12s. 8d.	(36) 1½d.
(6) £2 10s. 10d.	(24) £20 4s. 6d.	(37) 3s. 4d.
(7) £44 7s. 6d.	(25) 5s. 1d.	(38) £3 1s.
(8) Father £45 10s.; son £9 2s.	(26) £9 7s.	(39) 9½d.
(9) 420 parcels.	(27) £1 1s. 2d.	(40) £309 17s. 6d.
(10) 648 yards.	(28) £1 19s. 10d.	
(11) 34 gallons.	(29) 1s. 9d.	
(12) £1,297 10s.	(30) 110 of each.	
(13) £2 15s. 1½d.	(31) 697 coins.	
(14) £1,750.		
(15) £2 10s.		
(16) £1 10s.		
(17) 8s. 9d.		
(18) £12 18s. 6d.		

(Some of the Problems in this Series of Papers are based on those given by the Education Department.)

QUEEN'S SCHOLARSHIP EXAMINATION, JULY 1894.

List of Candidates to whom the Prizes and Certificates given by the Royal Geographical Society have been awarded.

MEN.

Prizes.

Name of Candidate.	School.
Ash, Frank	Slough B.
Barker, James A.	Hackney Wick, Gainsboro' Road Board.
Beck, Robert F.	Douglas, Tynwald Street Board.
Coney, Charles W.	Wanstead, Downsell Road Board.
Downing, Frederick W.	Beccles Board.
Drayton, Frederick J.	Ely National.
Duffill, Miles W.	Hoxton, Wellington Street Board.
Ennis, William C.	Hull, Chiltern Street Board.
Hubbuck, William A.	Ecclesfield, Wincobank Board.
Reid, Frederick M.	Bridport General Boys'.

Certificates.

Arnold, Charles E.	New Fletton B.
Bell, Edwin A.	Newbury National.
Bryant, John W.	Consett B.
Cooke, Daniel G.	Bristol, Temple Colston Church.
Fletcher, John T.	Eckington Board.
Hackett, William	Huddersfield, St. Andrew's Church.
Jones, Edwin A. A.	Maidenhead National.
Pritchard, Frederick	Loughborough, Cobden Street Board.
Trenouth, Ambrose	Devonport, Morice Town Board.
Wiseman, Stephen	Escombe Church.

WOMEN.

Prizes.

Abadi, Bessie	Hatcham, Monson Road Board.
Bollom, Maria F.	Stella St. Cuthbert's National.
Hindshaw, Winifred	Pendleton, Broughton Road Board.
King, Elizabeth D.	Tynemouth Western Board.
McEwen, Christina M.	Rhyl, Christ Church B.
Maher, Mary J.	Poplar, Upper North Street Board.
Midgley, Mary B.	Keighley, North Village Infant Board.
Rae, Mary S.	Battersea, Gideon Road Board.
Seward, Bessie W.	Bridgwater Girls' and Infants' National.
Talbot, Maud	Pendleton, St. George's, Wellington Street Board.

Certificates.

Atkinson, Margaretta	South Shields, St. John's Higher Grade.
Chirgwin, Emily	Swindon, College Street Board.
Daniels, Euphemia H.	Highbury, Gillespie Road Board.
Grime, Jessie	Manchester, Ducie Avenue Board.
Jacobsen, Margaret A.	Liverpool, Pleasant Street Board.
Marshall, Matilda E.	South Wimbledon Trinity.
Pierrepont, Frances H.	Nottingham Trinity National.
Thomson, Florence S.	Goswell Road, Moreland Street Board.
Westaway, Stella	Stoke Damerel B.
Whitworth, Elsie M.	Croydon B.

THE TOP SCHOLARSHIP STUDENTS
(FIRST AND THIRD)

Used the following publications, issued by Messrs. JOSEPH HUGHES & Co., in preparation for the recent Scholarship Examination:—

GEOGRAPHY.

DESCRIPTIVE GEOGRAPHY. By S. BROOK. 3s. 6d.

SCHOOL MANAGEMENT.

SCHOLARSHIP SCHOOL MANAGEMENT. By A. T. FLUX. 1s. 3d.

FRENCH.

JUXTALINEAR TRANSLATION of 'LA JEUNE SIBERIENNE.' By Prof. DARQUET. 1s. 6d.

London: JOSEPH HUGHES & Co., Froebel House, 4, St. Andrew's Hill, Doctors' Commons, E.C.

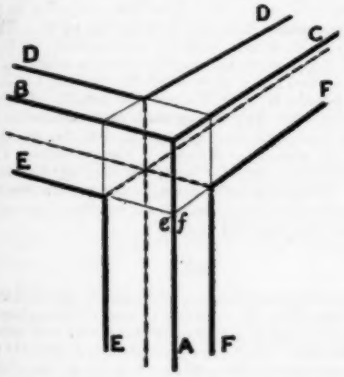
TEACHERS' DRAWING LESSONS.

MODEL.

STANDARD VI.

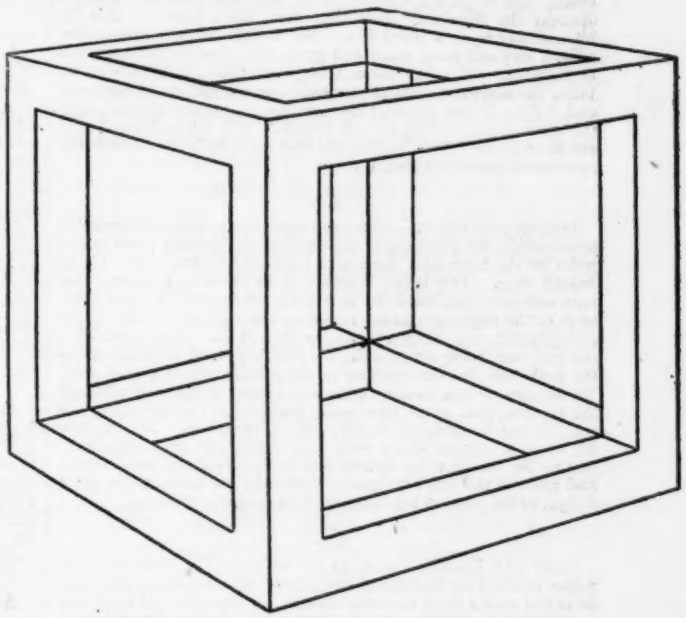
BY E. BUFFERY RIDGE,
Art Master under the London School Board.

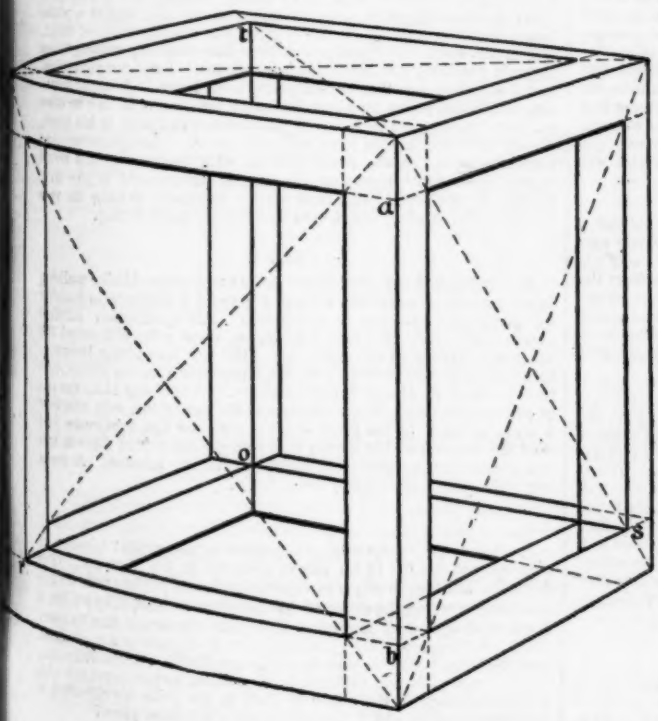
Skeleton Cube.—This is a rather difficult but very instructive model, especially when used as preliminary to exercises on table, cupboard, and other articles in drawing which thickness of material must be taken into consideration.



Take first *one corner* on a large scale. The outer edges ABC should first be drawn, then the inner edges DEF. These are made to agree with each other by extending them as shown in the figure by thin lines, forming a small cube, the hidden edges of which give the unseen lines of the model—dotted in the figure.

Draw *the whole model*—the outside edges as a solid cube, then the three squares of which the lines DEF in the preceding figure form parts. To obtain these squares accurately draw the diagonals of the three faces of the cube containing them, mark off at *a* and *b* on the front edge the thickness of the bars, and run vanishing





lines to cut the diagonals. The four corners of each of the two front squares are thus fixed, and vertical lines through them give points on the top edges from which to draw vanishing lines for the top inner square.

Draw next from points *r*, *s*, and *t* the three inside edges meeting at *o*.

The rest of the figure will present but little difficulty — careful consideration of where each line begins and ends, with the use of the vanishing points, being sufficient to complete it.

Pupils may with advantage draw this model from a copy, either freehand or with the use of rulers. They will become familiar with it, and gain readiness in making the different surfaces fit in with one another.

For this purpose a drawing of a skeleton square prism without working lines is added.

NEW COMPOSITION STORIES.—STANDARD V.

Suitable for 'Unseen Tests' in Reading also.

215.

SELF-CONVICTED THIEVES.—A large quantity of cotton had been stolen from a village in India; and in spite of all the exertions of the police of the town, the thieves could not be found out. One of the magistrates, annoyed that the power of the law should fail so openly and so grossly, determined to use every possible means to discover the offenders. Plan after plan failed, however, until he hit one day upon a novel idea. He invited all the men of the village, rich and poor, small and great, to a feast in the town-hall of the place. When all had met, and were taking their seats at the table, the magistrate looked the company straight in the face, and said, 'What ill-bred fellows these men are, to come to the feast with the stolen cotton sticking in their beards.' The thieves immediately put their hands to their beards, and thus convicted themselves in the presence of the whole assembly.

216.

INSTINCT OF GOATS.—There are a good many goats that scramble about within the precincts of the garrison at Gibraltar; and at one point of the huge rock there is a goat-road leading down to the water's edge. This track, however, is so excessively narrow, that only one goat can travel by at a time, while even a single false step, or the slightest attempt to run to the right or the left, would precipitate the animal from the top to the bottom. It happened that one goat was going down while another happened to be ascending the path, and the two meeting in the middle, made a dead stop. To attempt to turn or step aside was instant death, and although the topmost goat could have easily pushed his brother out of the way, he was too generous to take such an advantage. At last, they hit upon a scheme which even man could not have surpassed; that is, the one goat lay quietly and cautiously down on all fours, and allowed the other to march right over his body, to the great delight of the persons who witnessed this singular dilemma.

217.

HOW THE ROGUES WERE DEALT WITH.—The Paris detective police wrecked the business of the railway card-sharpers going to the races last season in an amusing manner. These men had long been a nuisance, and their numbers increased. It was determined to apply a simple but effective check. Of course the tricksters went in gangs. When the inspectors on watch saw a party of four distributed in a compartment, they took the first opportunity of coming to the door. 'Ladies and gentlemen,' the inspector would say, 'you have four card-sharpers in your midst. We think that two will be enough.' Thereupon two were marched out and shown into another carriage, with the simple introduction—'These are a couple of card-sharpers.' In this way, without the trouble of arrests and subsequent police proceedings, the whole plan of the rogues was spoilt.

218.

A HORSE JUDGING A PICTURE.—A famous artist painted a picture of the King of his country on horseback. Everybody said the picture was excellent, except the King himself, who was not satisfied with it. So the artist one day took the picture from the easel on which it was standing, and held it in front of one of the King's horses, while the King himself stood by. The horse, seeing another horse in the picture, neighed with pleasure. The artist turned to the King. 'The horse seems to be a better judge of a painting than your majesty.'

219.

SAVING A SHILLING.—At most of the cloth factories it is the custom to fine the workmen a shilling for turning out a bad piece of work. At a place where this fine was enforced a workman one day brought a piece of cloth to be examined by the manager. It was examined, and the manager found two little holes about an inch apart. He showed these to the workman, and demanded two shillings fine—a shilling for each hole. 'Is it a shilling for each hole?' asked the man. 'Yes,' replied the manager. 'And it is the same for every hole, big or little?' 'Yes, exactly the same.' 'Well, then,' said the man, 'I will save a shilling.' And putting his fingers to the holes he quickly made them into one. The man's wit so pleased the manager that he remitted the whole fine.

220.

A PERFECT LIKENESS!—A conceited fellow, whose whole bearing showed that he esteemed himself in understanding far above his fellows, visited Bethlehem Hospital, accompanied by a lady. Amongst the patients was a young man occupied at an easel. To him the conceited fellow addressed himself. After the young man had respectfully heard what he had to say, he thanked him for his instructive remarks, adding—'I hope, in return, you will allow me to draw your likeness to present to the lady.' 'With pleasure,' replied Mr. Conceit. 'Please sit down, sir. Head erect. A little more to the right. Body not so stiff. There! that'll do.' So saying, the artist rapidly plied his pencil. Soon he stepped forward with the result of his labours, saying, as he presented it to view—'There, sir; I think everyone will admit that that is a perfect likeness of you.' It was a very cleverly drawn goose.

221.

A FAITHFUL WATCH-DOG.—A common watch-dog one night followed his master, who was accompanied by a favourite valet, to his bedroom. Being deemed an intruder, he was instantly turned out; then he began scratching at the door, and howling loudly for admission. The valet was sent to drive him away, but he returned, and was more determined than ever to enter the room. The gentleman, being very tired, then let him in, and allowed him to do as he pleased; so the dog took up his night's quarters under his master's bed. The master had never cared much for the dog, but he allowed the animal to remain to save himself the trouble of driving him away. At midnight the door was opened, and a man came stealthily into the room; the gentleman sprang up, but the watch-dog had already pinned the assassin to the spot. The gentleman rang for a light, and the robber roared for help, for the dog had completely mastered him. When the light came, it showed that the valet had stolen into his master's room, intent on murder, for the sake of the plunder which he expected to get.

222.

HE WAS NOT CONTENTED.—An old gentleman had the following inscription carved on the doorway to one of his gardens: 'This garden shall become the property of the man who can prove that he is perfectly contented.' One day a stranger came and said: 'I have come to take possession of the garden; nobody in the whole world, I can truthfully say, is more content and happy than myself.' To which the old man replied: 'You are labouring under a delusion, sir. If you were thoroughly contented, you would not covet my garden.'

223.

A CLEVER THIEF.—A dandy, holding in his hand an expensive gold-mounted stick, was recently walking along a street in Paris, when a beggar on crutches came up to him, and in a pitiful tone asked for help. The dandy gave him a small piece of silver, and at the same moment a person near him suddenly cried: 'That rogue is deceiving you, sir! He is no cripple. Lend me your stick, and I will show you that he runs better than I can.' Without thinking, the foolish young man lent his cane; but no sooner had he done so, than the beggar threw down his crutches and took to his heels, closely followed by the man with the cane. The spectators, and particularly the dandy, stood shaking with laughter at this novel sight. Both the beggar and his pursuer disappeared at the next turning in the street, and their victim remained waiting in vain for his splendid stick, which had cost him so much money.

224.

A FORTUNE LOST THROUGH A FALSEHOOD.—While walking in the country, a young lad opened a gate for a comfortable-looking old gentleman who was on horseback. The gentleman, touched apparently by this little act of kindness, drew rein, and asked the name and address of the polite lad. He was facetiously informed that his name was Brown, that his father was a cheese dealer, and that he lived at Mount Street, London. Thanking him, the old gentleman rode on. Years afterwards the young lad, who was now a man, learned, to his great dismay, that the old gentleman had died and had left all his money to a young man named Brown, son of a cheese dealer, who lived in Mount Street, London. A more expensive joke was probably never made.

225.

A STORY OF NAPOLEON.—Napoleon I. was a great admirer of a certain actress, but by no means splendid in his liberality. One day, after alluding in terms of satisfaction to her performance on the preceding evening, he signified his intention of bestowing on her a mark of his approval, and asked her what she would like to have. 'Sire,' she replied, 'my great ambition is to possess a portrait of your Majesty.' 'Your wish is easily gratified,' said the Emperor, with a smile. Putting his hand in his pocket, he presented her with the desired effigy in the shape of (not, as she probably expected, a miniature, enriched with diamonds), but a five-franc piece!

226.

THE ORIGIN OF THE TEA PLANT.—There is a strange Chinese legend concerning the tea plant. According to the story, there once lived a very pious hermit, who passed the greater part of his time in prayer and vigils. He was, however, unable to keep awake as long as he wished, and often found his eyes closing while he was in the very midst of his devotions. This naturally annoyed him, and one day, in a fit of wrath against this weakness of the flesh which he seemed unable to overcome, he cut off the offending eyelids and cast them upon the ground. But his action had been observed by a god, who immediately caused a tea shrub to spring up from the spot where the eyelids had fallen. It is in reference to this that the leaves of the tea plant are shaped like eyelids, fringed with lashes, and possess the power of warding off sleep.

NEW READING TESTS.—STANDARD III.

Suitable for 'Unseen Tests' in Dictation also.

176.—The ostrich does not run in a straight line as most other creatures do, but constantly circles round. The practised huntsmen among the natives are aware of this, and do not attempt to follow it, as they could never hope to catch it so. They watch its course for a little while, just to see to which side it is bending, and then gallop straight across and meet it as it returns.

177.—A little six-year-old boy went into the country on a visit. About the first thing he had was a bowl of bread and milk. He tasted it, and then hesitated a moment, when his mother asked him if he didn't like it, to which he replied, 'Yes, mamma; I was only just wishing to myself that *our* milkman would keep a cow.'

178.—The flesh of the elephant is an important article of diet, especially among the natives, to whom the slaughter of an elephant is an occasion of great rejoicing. Some parts, such as the foot, are justly considered as especial dainties, but the greater portion of the flesh is stated by many travellers to be little superior in toughness and flavour to ordinary shoe-leather.

179.—One night a gentleman was driving home from the station, when suddenly his horses stopped. The coachman whipped them, but still they would not move a step farther; so the footman got down and lit a lantern to see what was the matter. What was his surprise to see a tree lying right across the road. You may be sure the gentleman was very pleased with his horses, because if they had gone on the carriage would have been upset.

180.—Many tame cats leave their homes and take entirely to a wild life, living on the game which they capture. When trapped, these are often mistaken by the keepers for the genuine wild species. It is hardly possible to pass through a preserve without noticing the dead bodies of several cats, which have been shot by the gamekeepers, and hung up.

181.—Little George was in the train the other day, and in the seat opposite to him was an old soldier, whose breast was covered with medals. George gazed at him and the medals long and earnestly, and at last looked up into his mother's face and said, 'Mamma, why does that man wear his money on his coat? Won't they let him have pockets?'

182.—There was once a gentleman who had a tame snake which showed him a good deal of affection—would come at his call, creep into his coat-sleeve, and lie quietly on his table while he was reading or writing. It used to have a little milk for breakfast, and its greatest treat was an occasional swim in a large basin of water.

183.—Field mice can easily make their power felt when allowed to have their own way, as many a farmer in France knows to his cost. In certain parts of that country the number of mouse-holes is enormous. The ground in some places is honey-combed with little burrows. In one district it has been reckoned that these mice have cost the farmers no less than £70,000.

184.—Quick as thought Tom caught at the broken rein as the pony at sight of him stopped short, and hesitated which way to go; he then succeeded in getting hold of it before the animal could make any further attempt at breaking away. Tom spoke in a soothing voice to the frightened creature, and as soon as it appeared more quiet he gently led it forward.—(H.M.I.'s Test.)

185. The cottage homes of England
By thousands on her plains,
They are smiling o'er the silvery brooks,
And round the hamlet fanes.
Through glowing orchards forth they peep,
Each from its nook of leaves;
And fearless there the lowly sleep,
As the bird beneath their eaves.

NEW DICTATION TESTS.—STANDARD IV.

Suitable for 'Unseen Tests' in Reading also.

No. 120.

In Russia, a child ten years of age cannot go away from home to school without a passport. Servants and peasants cannot go away from where they live without one. A gentleman residing at St. Petersburg or Moscow cannot receive the visit of a friend who remains many hours without notifying the police of his arrival, as the case may be. The porters of all houses are compelled to make returns of the arrival and departure of strangers. And for every one of the above passports a charge is made of some kind.

No. 121.

A touching old rural custom still prevails in the western parts of France during the harvest season. On the edge of a field bordering the highway a sheaf of grain is left standing, to which all the peasants of the village contribute, and which is called 'the stranger's sheaf,' as it is the property of the first tramp or other homeless wayfarer who may care to carry it away and profit by its price.

No. 122.

People who get through an immense amount of work are always those who know that idling must not be allowed to put forth a covetous hand and steal five minutes here and half an hour there. They can obtain a succession of successful results of application. It is often found that the busiest folk are those who can find time to do a kind act to a friend or neighbour, for they know how to fit in one thing with another, till they are actually said to be able to 'make' time.

No. 123.

The storks pass the winter in the warmer climes of Africa. When the time for migration has arrived, they leave in great flocks, flying at a considerable height. Their wings are large and have a great sweep, and consequently their flight is powerful. The company of pilgrims when at rest afford much amusement to onlookers, and as they have the habit of constantly clacking their bills together, it will be easily believed that the uproar thus caused is a terrible nuisance.

No. 124.

What the world needs to-day is not men who are looking for easy jobs, but men who are so strong, and vigorous, and courageous, that they are ready for anything that comes to hand, and able to

accomplish what they undertake. These are the men who conquer and control circumstances, who win the prizes in the race of life, who can choose their occupations, and finally become the masterful leaders, the equal of the great, and patterns to those around them.

No. 125.

The longest flag made is the pennant in use in the navy, which is very narrow and tapering, and is twenty yards in length. It is flown from the mast-head of every ship of the British navy when in commission, and is white with a red cross. In time of war a flag of truce is white; striking, or lowering, the flag denotes surrender. The flag of one country placed over another signifies the ship has been captured; a red flag intimates mutiny; a black flag is displayed by piratical vessels; and a yellow one shows that sickness is on board.

No. 126.

A novel postal experiment has lately been tried. It consists in attaching letter-boxes to the tram-cars, in which letters can be posted, the boxes being cleared by the post-office officials on the arrival of the cars in town. If a person desires to stop the car for the purpose of posting a letter, a penny has to be paid, which is placed by the conductor in the fare-box. On the opening day the number of letters dropped into these travelling boxes exceeded 500. —(H.M.I.'s Test.)

No. 127.

A carpenter's right shoulder is almost invariably higher than his left, in consequence of having to use his right arm all the time in planing and hammering. With every shaving his shoulder rises with a jerk, and it finally becomes natural to him to hold himself in that way. The head of a bricklayer's labourer is held aloft with a haughty, self-reliant air, from his habit of carrying a hod on his shoulder and looking above him as he climbs up the scaffolding.

No. 128.

There is a hot region in the Persian Gulf where little or no rain falls. Fresh water is got by diving. The diver winds a large goat-skin bag round his left arm, his hand grasping the bag's mouth. He next takes a heavy stone to which a stout line is fastened, and then plunges in the sea. As soon as he reaches the bottom he opens the bag over the strong jet of fresh water, ascends with the upward current, shutting the bag the while, and is helped on board. These submarine springs are believed to have their source in hills 500 miles distant.

No. 129.

An Englishman's house is his castle,
A stronghold protected by love,
Where beams the pure light of contentment,
Reflected in rays from above;
There's no land can boast the same feeling,
And search as you may through the world,
'Home' only is known where the banner
Of England is proudly unfurl'd.

STANDARDS V.—VII.

No. 110.

EXERCISE oils the joints of the body and prevents them from growing stiff. It needs no money, very little time, little or no present strength. One thing only it does need, that is perseverance. One third of the time often given to the piano will more than suffice. One less study a day to those which are to-day overtaxing so many school-girls, and instead, judicious, vigorous, outdoor exercise, aimed directly at the weak muscles, and taken as regularly as one's breakfast, and is there any doubt which will pay the better, and make the girl the happier, the better fitted for all her duties, and the more attractive as well? It is as necessary to develop vigorous, healthy bodies as it is to cultivate the mind, for what is mental power without bodily strength?

No. 111.

IT is significant that some of the hardest-worked men and women intellectually find a light, wholesome story refreshing and restful. Keen-witted barristers and solicitors will read and enjoy stories which even the ordinary novel-reader will find insufferably foolish, and the reason for this is that they break the current of habitual thought, and invite a return to more normal and less strained conditions of mind. A few light novels, wisely interposed between serious studies and cares, vastly benefit men and women to whom life grows monotonous from lack of change of mental occupation and atmosphere. The trifles that amuse and divert weary and exhausted minds serve a real purpose in the economy of life, and it is ignorance alone which condemns them.

No. 112.

THERE is an art of reading, although many who read never master it; an art to be acquired, as all arts are acquired, by long and patient practice. Those who learn this art not only read books, but remember them; not only gain the enjoyment of the first keen impression of a writer's style and thought, but make his thinking a part of their own intellectual possession for ever after. There are people who are continally making the casual acquaintance of books but never establishing relations of enduring friendship and intimacy with them. They recall books as they see the titles from time to time, but they do not recall when they once knew of them. There is no cohesion between such a reader and the books that have passed under his eye.

No. 113.

THE largest steam-hammer in the world is said to be the huge piece of machinery in Woolwich Arsenal by means of which the monster Woolwich Infants are forged. Its striking force is a thousand tons, and the 'infants' turned out by this truly striking apparatus are estimated to carry a ball of a ton weight a distance of nearly eight miles! In these degenerate days of bursting guns and jamming cartridges it is comforting to reflect that in a baby weapon of this make we have at least one tangible implement of war as solid, albeit as impracticable, as British brains and muscles can make it.

No. 114.

THE practice of offering flowers at the graves of the dead is so old that we cannot trace its origin. The early Christians used to scatter flowers over the tombs, and hang garlands upon them; but this custom they borrowed from the Greeks and Romans, who had followed it longer than they themselves could tell. The practice is so in keeping with natural feeling, that it would spring up of itself among any cultivated people. In England it used to be the practice to whiten the tombstones at Christmas, Easter, and Whitsuntide. On the same principle of delicate respect, the graves in some parts of the country were strewn with flowers at least three times a year. It is curious to note that the flowers which were placed on the graves, or planted there, were only such as are sweet-scented.

No. 115.

THE persons who despise small savings as unworthy of their care are ignorant of the main object of making them in early life, which looks not chiefly to the saving itself, but to *the formation of a habit of economy*. It is true, the saving of a few pence is in itself of little moment; but if the habit of saving a penny or two, whether in money or any other kind of property, once becomes fixed, and the thoughts be turned in the direction of advancement, the accumulation will go on and be ultimately successful. There is no revolution in the history of a man so important in its consequences as that which takes place at the moment of the first saving.

No. 116.

STRENGTH of character consists of two things—power of will, and power of self-restraint. It requires two things, therefore, for its existence—strong feelings and strong command over them. Now, it is here we make a great mistake; we mistake strong feelings for strong character. A man who bears all before him—before whose frown domestics tremble, and whose bursts of fury make the children of the household quake—because he has his will obeyed, and his own way in all things, we call him a strong man. The truth is, that is the weak man; it is his passions that are strong; he mastered by them is weak.

No. 117.

THERE is, perhaps, no mistake of the young more common than that of supposing that, in the pursuits of life, extraordinary talents are necessary to one who would achieve more than ordinary success. The wants of society raise thousands to distinction who are not possessed of uncommon endowments. The utility of actions to mankind is the standard by which they are measured, and not the intellectual supremacy which is established by their performance. But very ordinary abilities will suffice to make a man eminently useful; and surpassing talents have frequently been unserviceable in proportion as they were objects of admiration. Worldly success depends less on the general superiority of one's intellectual powers than on their peculiar adaptation to the work in hand.

No. 118.

LORD WOLSELEY writes:—'I take the German army as the highest existing type of the military system and organization which the changes effected in armies by the French revolution have led up to; and much as I admire that army as a soldier, I admire it still more as a citizen. Great as it is for war, it is infinitely greater as a national school for the moral, mental, and physical training of the

people. Designed exclusively for war, it has become the most important of peace institutions. In it all Germans are trained to strength, and taught the first principles of personal cleanliness and of health. There they learn to be honest and manly, and are taught the excellence of those virtues which serve to make men good subjects and law-abiding citizens. It is the school of the nation, in which deep love of fatherland is fostered and cherished, and where all classes learn that there is honour in obedience and nobility in self-sacrifice.'—(H.M.I.'s Test.)

No. 119.

HAIL, Sabbath! thee I hail the poor man's day.
On other days, the man of toil is doom'd
To eat his joyless bread, lonely, the ground
Both seat and board, screen'd from the winter's cold
And summer's heat by neighbouring hedge or tree;
But on this day, embosom'd in his home,
He shares the frugal meal with those he loves;
With those he loves he shares the heartfelt joy
Of giving thanks to God—not thanks of form,
A word and a grimace, but reverently,
With cover'd face and upward earnest eye.

NOTES ON 'MADEMOISELLE DE LA SEIGLIÈRE.'

BY W. T. THOMPSON, B.A. (LOND.).
(*First Class French Honours.*)

The figures at the beginnings of the lines refer to the pages and lines of Macmillan's Edition (Foreign School Classics, 1s. 6d.). Thus 4.16 means p. 4, l. 16. As we quote the acts and scenes also, it should be possible for a student using any other edition to use these notes with advantage.

ACT III.—SCENE 1.

60.1.—*qui prépara Wagram*, who paved the way for Wagram. At Wagram, Napoleon gained a decisive victory over the Austrians in 1809.

60.3.—*Encore un prince!* Another prince! Berthier was created Prince of Wagram for his share in the success of the battle.

60.7.—*la fille des Césars — à un petit officier de fortune*, the daughter of the Cæsars (married) to a little soldier of fortune. *Petit* expresses the contempt of the Marquis for the conqueror, and refers also to Napoleon's shortness of stature.

60.7.—*en dépit de toutes les règles*, spite of all the rules. The Marquis reproaches Napoleon for what is considered to be one of his greatest merits as a general, *i.e.* that he broke the traditional rules of war wherever he saw he could gain an advantage in a battle.

60.14.—*Vous vous le rappelez* (lit. You recall it to yourself), You remember.

60.14.—*lors de*, at the time of.

60.15.—*à peine installés*, scarcely settled down.

60.17.—*nous dûmes décamper au plus vite*, we had to pack off as fast as possible. *Dûmes*, pret. ind., 1 pl. of *devoir*, owe, ought. *Décamper* is lit. 'to strike one's camp.'

60.18.—*moins de*, less than. *Moins* from Lat. *minus*, less. *De* = 'than' before a numeral.

60.19.—*C'en était fait de*, It was all up with. This refers to the campaign in which Napoleon gained the battle of Jena, and laid Prussia prostrate at his feet.

60.22.—*Quel manque de formes!* what lack of form! In the cant of the present day, 'What bad form!'

60.23.—*Guerre de sept ans — de trente ans.* The Seven Years' War lasted from 1756 to 1763, and was waged by Frederick of Prussia in alliance with England against a combination of European powers.

The Thirty Years' War was the great religious war which raged in Germany from 1618 to 1648. It was during this war that the son-in-law of James I., the Elector Palatine of the Rhine, who had been induced to accept the crown of Bohemia, not only lost Bohemia, but was deprived of his ancestral possessions.

60.27.—*Il ne peut plus faire des siennes*, He can no longer play his tricks.

60.31.—*mis à la raison*, reduced to reason.

60.32.—*Pour en venir à bout*, to accomplish it. Distinguish *bout*, the *end* or remotest part of an object, the *end* of an enterprise, from *but*, the *end* at which a person aims.

61.6.—*Pas un mot de plus . . . pour mon père!* Not a word more! . . . for my father's sake!

61.13.—*se remet à son dessin*, recommences her drawing. *Se mettre à* = to begin; *se remettre à*, to begin again.

61.13.—*se rapproche d'elle*, draws near her. *Se rapprocher de* = to approach. But *rapprocher* (*e.g. deux personnes*), to bring two persons together; to reconcile two persons.

61.13.—*s'assied*, pres. ind., 3 sing. of *s'asseoir*, seat oneself.

61.13.—*ce qui vient de se passer*, what has just passed. *Se passer* = to happen.

61.18.—*Est ce qu'oublieuse de . . .?* Is it possible that forgetful of . . .?

61.19.—*elle partagerait*, she perhaps shares. This is an example of the *dubitative* sense of the conditional tense.

61.20.—*J'y veillerai*, I will watch over it.

SCENE 2.

62.4.—*Je vous le donne en cent*, lit. 'I give it to you in a hundred.' It means 'You may have a hundred guesses at it,' and hence 'You will never guess.'

62.9.—*Déjà de retour*, already come back!

62.11.—*Facheux contre-temps!* (What an) annoying mischance!

62.15.—*des plus ingambes*, (one of) the briskiest, liveliest. Translate, 'As lively as possible.'

62.15.—*à grands pas le long de l'avenue*, with long strides along the avenue.

62.17.—*Que lui dire?* lit. 'what to say to him?' Translate 'What shall I say to him?' The infinitive is used in this way in questions which are only a more graphic way of stating a negative. For example, *Que faire?* = 'What shall I do?' when the speaker wishes to express that he does not know what to do.

62.18.—*viendrait-il recevoir*, perhaps he has come to receive. Notice again the conditional used in a *dubitative* sense.

62.21.—*arrivez donc*, come in then.

SCENE 3.

62.29.—*Je m'en doute bien*, I think so. *Se douter de*, (something) to surmise, conjecture (something).

63.1.—*Soyez le bienvenu*, lit. 'Be the well-come.' Translate, 'Welcome.'

63.3.—*Il n'y a que — gens*, 'No one is equal to the Baroness for turning a compliment in this fashion.'

63.6.—*Et qui vous le rendent*, and who return it to you.

63.16.—*Que chante donc la Quotidienne?* What does the *Quotidienne* mean then? See the extract read by the Marquis from this paper, Act III., Scene I.

63.19.—*tirer ma révérence*, make my curtsey.

63.23.—*Il serait possible?* Can it be possible?

63.26.—*Je n'en reviens pas*, I am quite surprised. Lit. I do not return (*or* recover) from it, *i.e.* from my surprise.

63.27.—*qui m'en veut*, who has a spite against me. Lit. 'who wishes something (evil) to me.'

63.28.—*d'avoir su lire*, for having been able to read.

63.36.—*l'a emporté*, has gained the day.

64.1.—*Voilà.* That is just it; you have hit it.

64.4.—*je m'en plaindrai*, I will complain of it. *Se plaindre de* (something) = to complain of.

64.7.—*je reste avocat, comme par le passé*, I remain a barrister, as in the past. Notice that no article is attached to the name of a profession or employment when it is used with link verbs such as *to be*, *become*, etc., and is therefore in apposition with some noun or pronoun.

64.8.—*Mettre sa parole*, to put one's talents (*lit.* speech). The possessive of the indefinite pronoun *on* is represented by *son*, *sa*, or *ses*.

64.9.—*dépister*, verb, inf., track, ferret out. *Piste*, noun, fem. = track.

64.11.—*ne le pensez-vous pas?* do you not think so?

64.14.—*La philosophie fut de tout temps*, Philosophy has always been.

64.19.—*d'abord . . . et ensuite*, in the first place . . . and in the second place.

64.27.—*ne s'appartient pas*, lit. does not belong to himself; is not his own master. Translate, 'is engaged.'

64.30.—*je dois porter*, I have to take.

64.32.—*veut bien m'attendre*, is kind enough to wait for me. *Vouloir bien* with an inf. = 'to be kind enough.'

64.34.—*êtes-vous des nôtres ?* 'will you join us?'

65.1.—*maladroit !* Clumsy ! *i.e.* in allowing a rival to monopolise the society of Hélène.

65.3.—*J'ai hâte*, I am in a hurry.

65.7.—*S'ils comptent là-dessus*, if they depend on that. *Là-dessus* is literally our word *there-upon*.

65.8.—*puisqu'il en est ainsi*, since such is the case.

65.11.—*Sans rancune, mon brave*, without malice, my good fellow.

Stage directions.—poignée, noun, f., lit. handful, from *poing* (Lat. pugnus), fist.

The termination *ée* added to nouns has the same effect as our *ful*, as *bouchée*, mouthful, *potée*, potful.

Il donne une poignée de main à Bernard, he wrings Bernard's hand.

SCENE 4.

65.14.—*je n'en saurais revenir*, I am not able to overcome my surprise at it. See note on 63.26.

65.15.—*Qu'a donc M. Destournelles ?* What is then the matter with M. Destournelles ?

65.15.—*On le dirait étonné de*, One would say that he is astonished at.

65.17.—*On n'est pas plus adroits*, no one could be more adroit.

65.22.—*Vous voilà revenu*, you are now returned.

65.25.—*Il suit du regard*, he follows with his eyes. *Suit*, pres. ind. 3 s. of *suivre*, follow.

65.26.—*en tête-à-tête*, in a private interview, lit. 'in head-to-head.' The Germans express the same idea by the phrase *unter vier Augen*, 'under four eyes.'

66.1.—*de quel côté se trouve*, on what side is.

SCENE 5.

66.6.—*l'on soupire ici*, there is love-making (lit. 'sighing') here. *Soupir*, a sigh, from L. *suspirium*.

66.6.—*Place au trouble-fête*, make way for an inconvenient guest (lit. 'the mar-pleasure.')

66.7.—*Voici le seigneur Rabat-joie* (lit. here is lord End-joy). I am come to put an end to your pleasure. *Rabat* is from *rabattre*, to abate, diminish.

66.2.—*Vous n'avez rien fait*, you have done nothing. *Rien* and *tout*, when direct objects of a compound transitive verb, are placed between the auxiliary and the past participle.

66.26.—*J'aviserai*, I will think it over. But *s'aviser de faire quelque chose* is 'to take into one's head to do something.'

66.27.—*De quoi s'agit-il ? . . . de venger votre père.* What question are we considering ? . . . (the question) of avenging your father.

67.2.—*Je comprends qu'un pareil séjour ait amolli votre cœur*, I can understand that a residence there has softened your heart. Bernard's father had lived and died in this house.

67.11.—*en maître*, as master; in the character of master.

67.11.—*mon avis*, my opinion; *not* my advice. 'My advice' would be *mon conseil*.

67.12.—*Voilà six semaines*, six weeks ago.

67.20.—*on avait su m'inspirer quelques préventions*, people had been able to instil certain prejudices into me. *Savoir* when used in the sense of *pouvoir* is followed directly by the infinitive. For *prévention*, see note on 58.17.

67.22.—*Vraiment !* indeed! in an ironical sense. This is a very common use of *vraiment*.

67.23.—*que ce ne sont pas là de nobles cœurs*, that those are not noble hearts.

67.26.—*Moi*, I. The disjunctive *moi* translates 'I' (*a*) when used as here, in answer to a question; (*b*) When coupled by a conjunction with a noun or pronoun; (*c*) After the conjunction *que* (than); (*d*) In exclamations, as in 68.5.

67.35.—*Est-il besoin ?* Is there need?

67.36.—*pas un mot de plus*, not a word more.

68.7.—*atteint et convaincu*, arraigned and condemned.

68.6.—*Geste de dépit*, an angry gesture.

68.8.—*Vous voilà dans une jolie passe*, you are in a pretty mess.

68.8.—*Comment comptes-vous en sortir ?* how do you intend to get out of it?

68.10.—*Mon parti est pris*, my resolution is taken.

68.10.—*Vous en penserez ce que vous voudrez*, you will think what you please about it.

Penser de = to have an opinion about something.

Penser à = to think about, have one's thoughts fixed on.

68.18.—*Je suis né*, I was born. The French use the *present* with the participle *né* when speaking of someone who is *still living*.

68.22.—*tête baissée*, headlong, blindly (lit. 'head lowered').

68.28.—*Je parierais même*, I would even wager.

68.31.—*ne se doute même pas de ce qui se passe*, does not even surmise what is happening. See 62.29.

68.33.—*Vous souvient-il de l'apologue ?* do you remember the fable? *Il me souvient de quelque chose*, or *Je me souviens de quelque chose* = I remember something.

68.35.—*laissons là la baronne*, let us have done with the baroness; let us dismiss the baroness. See note on 59.12.

69.2.—*sans s'en douter*, without suspecting it. See 62.29.

69.4.—*Quant à*, as for.

69.6.—*Cela m'est vraiment bien égal*, that is in truth a matter of indifference to me. *Cela m'est égal* = that is all one to me.

69.8.—*que je ne pensais*, than I thought. In a sentence depending on a comparative, *ne* is introduced when the sentence is affirmative in English. But the *ne* disappears if the verb in the principal sentence is interrogative or negative.

69.8.—*si je ne trouve un moyen*, unless I find a means. *Si . . . ne*, unless = Lat. *nisi*, which is compounded of the negative *ni* and *si* (if). The order of these particles is inverted in French.

69.10.—*Si la baronne s'était prise dans son propre piège.* Suppose the baroness had been taken in her own snare. The baroness was using the charms of Hélène to induce Bernard to waive his rights, not thinking that Bernard might become a serious rival to her own son in the affections of Mdlle. de la Seiglière.

69.12.—*Il est bien*, he is good looking.

69.12.—*depuis six semaines ils ne se quittent pas*, for the last six weeks they have not left one another's side. The present tense is used here because the state of things alluded to was still continuing at the time of this conversation.

69.20.—*Comment ?* What?

69.25.—*Préfèrez-vous que ce soit ?* Had you rather it should be? The subjunctive *soit* is used after the interrogation *préférez-vous ?*

69.33.—*Allons donc ! . . . . vous êtes du bois dont l'empereur faisait des princes.* Nonsense! you are made of the stuff of which the emperor made princes.

69.36.—*à laquelle je suis prêt à renoncer*, which I am ready to renounce. *Renoncer* is followed by *à*.

70.3.—*qu'à cela ne tienne*, don't trouble about that.

70.3.—*à la fois*, at one and the same time; both. *Fois* is 'time' in the sense of repetition; *temps* is 'time' in the sense of duration. *Temps* also = 'weather.'

70.8.—*un bon diable*, a good fellow.

70.8.—*qui n'a pas d'armoiries*, who has no coats of arms, *i.e.*, who does not trouble himself about artificial social distinctions.

70.11.—*vertudieu*, bless my heart. Appears also as *vertuble*u, and in a contracted form as *tudieu*.

70.13.—*la grande armée*, the army which Napoleon led into Russia.

70.14.—*déclarez-vous*, make your declaration (of love).

SCENE 6.

70.18.—*mon chevalier*, my knight; my gallant.

70.20.—*félonie*, noun, fem. sing., a treason.

70.30.—*il se dispose*, he is getting ready.

71.4.—*pour peu que vous l'en pressiez*, if you press him just a little to do so.

71.7.—*Il y est résolu*, he is resolved to do so (lit. 'resolved to it'), *y* is used because the verb *résoudre* is followed by *à*.

71.8.—*qui puisse l'en empêcher*, who can prevent him doing so. The subjunctive *puisse* is used because the sentence follows and depends on the superlative expression *une seule personne*.

71.10.—*aussi*, therefore. *Aussi* used in this sense usually requires that the subject and predicate following it shall be inverted in order.

SCENE 7.

71.15.—*Ce qu'il vient de dire est-il vrai ?* Is what he has just said true ?

71.17.—*Il le faut*, it must be so.

71.22.—*Je dois le croire*, I must believe it.

71.22.—*Car*, for (a conjunction, Lat. *quare*). But the preposition 'for' is *pour* (Lat. *pro*).

71.27.—*je ne sais que croire . . . . qu'imaginer.* I know not what to believe . . . . what to imagine.

71.28.—*Mon père aurait-il involontairement ?* Can it be that father has involuntarily ? Another example of the *dubitative* use of the conditional tense.

71.31.—*S'il lui est arrivé*, If he has chanced.

72.2.—*il ne faut pas lui en vouloir*, you must not bear him any ill-will on that account. See note on 63.27.

72.2.—*Je n'ai qu'à me louer de monsieur le marquis*, I have no reason to be displeased with the marquis.

72.6.—*Sans m'en douter.* See note on 69.2.

72.9.—*tâche*, from *tâcher*, endeavour. But *tacher* = to stain, spot.

72.11.—*On ne s'en va pas*, people do not go away. *S'en aller* = to go away. Compare *s'en retourner*, to come back again. In *s'envoler* and *s'enfuir* the pronoun *en* has become prefixed to the verb, as if it were the verbal prefix *en* (in, into). These constructions of reflexive verbs with the pronoun *en* are found in other Romance languages. Compare Italian *andarsene* (= *aller-se-en*).

72.13.—*s'est passée*, has been passed. *Se passer* also = to happen, *Se passer de* = to do without.

72.19.—*prendre un parti*, form a resolution; make up your mind. See note on 68.10.

72.21.—*printemps*, noun masc., spring. Lat. *primum tempus*, first or earliest time.

72.24.—*Vivre de votre vie*, To share the life you lead.

73.1.—*à quoi bon vous affliger*, what use is there in grieving yourself.

73.5.—*Qu'est-ce dont que ce mal ?* What is then this grief ? The second *que* is expletive.

73.10.—*je crains d'entrevoir*, I fear to get a glimpse of.

73.11.—*Si je vous le disais*, suppose I told it you.

73.12.—*le martyre*, the martyrdom. But *le martyr*, the martyr.

73.16.—*Il est peut-être au monde une personne*, There is perhaps someone in the world.

73.17.—*Il se tait*, he is silent. *Se taire* = to be silent. But *taire* (trans.) = to say nothing of; to conceal.

73.23.—*ce que vous devez souffrir*, what you must suffer.

74.3.—*Il n'est pas de couronne*, there is no crown. *Il n'est pas* = *il n'y a pas* here.

74.3.—*dont son front n'eût rehaussé l'éclat*, whose glory her brow would not have enriched.

The subjunctive *eût* is used as the sentence depends on a negative expression (*il n'est pas de couronne*). In many such cases, a negative in the dependent sentence is expressed by *ne* alone.

74.5.—*tout les dons en partage*, a share of every gift. *Don* from Lat. *donum*, gift.

74.8.—*envers*, prep., towards, is used only of the feelings. *Vers* = towards, when place is meant.

74.17.—*je vous ai vue*, I saw you. The past participle agrees like an adjective with the direct object of a compound transitive verb, when this object precedes the past participle.

74.20.—*résister au charme*, resist the charm. *Résister* is followed by à. As in the case of *obéir* and several other verbs, *résister* is followed by *à* because the Latin verb from which it is derived governs the dative case.

74.25.—*n'est-ce pas ?* do you not ? *N'est-ce pas ?* translates do I not ? dost thou not ? etc.

SCENE 8.

75.2.—*Qu'est-ce donc, mes amis ?* What is the matter then, my friends ?

75.5.—*Est-ce que . . . ?* Is it possible that . . . ?

75.12.—*nous allions partir*, we were just about to set off.

75.20.—*lui avoir entendu dire*, to have heard him say.

75.22.—*tantôt*, just now.

75.24.—*Il a changé d'avis*, he has changed his mind. *Changer de* = to take one thing in place of another of the same sort.

75.29.—*bien-être*, noun, masc., sing., comfort.

76.1.—*aux termes où vous en êtes*, considering the position in which you stand (towards each other).

76.3.—*qui vous unissent depuis votre enfance*, which have united you since your birth. The present tense is used because the state of things denoted by the verb is to be represented as *still continuing* at the time these remarks were made.

76.7.—*Il n'a pas eu de peine*, he has had no difficulty.

SCENE 9.

76.10.—*le jarret dispos*, in good trim for walking. *Jarret* is the ham of the leg. *Avoir du jarret* = to be a good walker or dancer.

76.11.—*Sois glorieuse*, lit. be proud. Translate 'Congratulate yourself.' *Glorieux* is from Lat. *gloriosus*, boastful, conceited, proud.

76.12.—*jette la science aux orties* (lit. throws science to the nettles). Translate 'abandons the pursuit of science.'

76.13.—*gare les distractions le long du chemin*, beware of distractions along the road. *Gare !* = beware of !

By the laws of consonantal change, this word is represented in English by *ware*. Compare *guerre* and *war ; guêpe* and *wasp*.

76.19.—*je n'aspire qu'à vous donner*, my only aspiration is to give you.

76.21.—*se fait*, becomes.

76.21.—*un madrigal galamment tourné*, a madrigal turned in loverlike fashion.

76.27.—*de se marier*, to get married. The verb *marier* used alone is applied to the parents who *marry* their children, or to the clergyman who *marries* a couple.

77.2.—*que cela regarde*, whom that concerns.

77.7.—*je me soutiens à peine*, I can hardly support myself.

Stage directions.—approche, brings up ; brings near.

77.14.—*qu'as-tu donc ?* what is the matter with you then ?

77.20.—*Serait-ce . . . ?* Is it possible . . . ?

77.21.—*le grand air*, the open air. *Grand jour* = broad daylight.

77.22.—*me remettra*, will put me right again.

77.23.—*vous aviez bien besoin . . .* was there any need then ? The Marquis rightly attributes his daughter's agitation to the persistency of the Baroness in urging her to name the day for her marriage with Raoul.

77.28.—*de me les avoir rappelés* (lit. for having recalled them to me). Translate 'for having reminded me of them.' See 74.17.

77.33.—*Mon fils et moi nous ne vous quittons pas*, My son and I are not leaving you. *Moi* = 'I,' according to the note on 67.26. When a subject is compounded of several subjects of different persons, a pronoun is used after them which sums them up in one. Here the resuming pronoun is *nous* (= *mon fils et moi*).

78.1.—*de vous laisser ainsi*, for leaving you thus.

78.3.—*Partie gagnée*, the game (is) won. *Partie* is a game (of cards, chess, etc.).

SCENE 10.

78.4.—*De quoi s'agit-il ?* What is the matter ?

78.13.—*Je saurai les remplir*, I shall know (how) to fulfil them.

78.16.—*la fuir pour jamais*, to leave her for ever.

78.20.—*Chez un notaire*, To a notary's. That is, he was going to what we should call a solicitor to get the deed drawn up conferring his property on Hélène.

SCENE 11.

78.22.—*malgré eux*, in spite of themselves.

THE 1894 SCHOLARSHIP EXAMINATIONS.

BY GEORGE BEACH, M.A., LL.D. (DUBLIN).
Author of '*Elements of English*,' '*A Girls' Arithmetic*,' '*Entertaining Readers*,' *etc.*

I. Candidates for December's Examination whose Reading, Recitation, and Teaching were adjudicated upon for July's ordeal, need not again go over these exercises. We are officially informed that '*the marks already awarded will be carried over for December.*'

II. It is not too late to procure 'SCHOLARSHIP SCHOOL MANAGEMENT,' by MR. FLUX. We cannot too highly praise this little work. It is of very moderate compass, attractively written, and so closely corresponding to the requirements, that any one intelligently mastering its contents can confidently rely upon maximum marks for this subject.

III. RESULTS OF JULY'S EXAMINATION *compared with last seven years.*

SUMMARY.

Years.	Sat for the Examination.			CLASS PASSES.									Passes.			Failures.		
				1st Class.			2nd Class.			3rd Class.								
	Men.	Women.	Total.	Men.	Women.	Total.	Men.	Women.	Total.	Men.	Women.	Total.	Men.	Women.	Total.	Men.	Women.	Total.
1887	1943	3315	5258	295	597	892	734	1240	1974	233	334	567	1262	2171	3433	681	1144	1825
1888	1843	3409	5252	262	605	867	708	1237	1945	232	336	568	1202	2178	3380	641	1231	1872
1889	2178	3867	6045	342	740	1082	776	1298	2074	256	415	671	1374	2453	3827	804	1414	2218
1890	2347	4594	6941	538	836	1374	938	1805	2743	247	354	601	1723	2995	4718	624	1599	2223
1891	3094	7900	10994	488	1491	1979	1053	2887	3940	341	798	1139	1882	5176	7058	1212	2724	3936
1892	3096	7730	10826	474	1397	1871	1315	2454	3769	465	1915	2380	2254	5766	8020	842	1964	2806
1893	2698	6813	9511	333	1192	1525	1078	1982	3060	380	1577	1957	1791	4752	6543	907	2061	2968
1894	2155	5919	8074	296	1122	1418	1019	1907	2926	319	1424	1743	1634	4453	6087	521	1466	1987

PERCENTAGES.

Years.	CLASS PASSES.									Passes.			Failures.		
	1st Class.			2nd Class.			3rd Class.								
	Men.	Women.	Total.	Men.	Women.	Total.	Men.	Women.	Total.	Men.	Women.	Total.	Men.	Women.	Total.
1887	15	18	17	38	37·5	37	12	10	11	65	65·5	65	35	34·5	35
1888	14	18	16·5	38·5	36	37	12·5	10	10·5	65	64	64	35	36	36
1889	15·5	19	18	35·5	34	34	12	11	12	63	64	63	37	36	37
1890	23	18	20	40	39	39	10·5	8	9	73½	65	68	26½	35	32
1891	16	19	18	34	36·5	36	11	10	11	61	65	65	39	35	35
1892	15·5	18	17	42·5	32	35	15	25	22	73	74·5	74	27	25·5	26
1893	12·5	17	16	40	29	32	14	23	21	66½	70	69	33½	30	31
1894	13·5	19	18	47	32	36	15	24	21	75½	75	75	24½	25	25

IV. A CORRECTION.—By a printer's error we were made recently to say that a Perfect Fourth became upon inversion an '*Imperfect* Fifth.' For *Imperfect* read '*Perfect*'; we stated correctly in the January issue that '*A perfect interval when inverted produces another perfect interval.*'

V. ENGLISH.

There are always compulsory questions on Composition, Parsing, and Analysis. Of late years ten questions have been given, of which the first two (see preceding sentence) must be answered, and of which any four of the last eight may be replied to.

The composition themes have been as follows :—

1. Early signs of Spring.
2. Some museum with which you are acquainted.
3. Some act of kindness or heroism which you may have witnessed.
4. Some of the difficulties of a young teacher's life.
5. Gardening.
6. A storm at sea.
7. A day's angling.
8. Some public park.
9. Common fruits.
10. Football.
11. Modes of travelling.
12. The advantages and disadvantages of living in an old or a newly-settled country.
13. Singing birds.
14. Fairy tales.
15. Best way of spending holidays.
16. Advantages of the study and knowledge of Geography.
17. Your favourite flowers and the way to cultivate them.
18. The moral lessons of the microscope and the telescope.
19. Advantages and disadvantages of town versus country life.
20. Examinations.
21. Truthfulness in act and word.
22. Poetry.
23. Our Queen rules over an empire on which the sun never sets.
24. A ship on fire.
25. Closer union with our colonies.
26. A walk round a garden.
27. Good manners.
28. The commercial importance of the telegraph or telephone.
29. The advantages of a school library.
30. Any memorial place, city, castle, or battle-field which you have visited.

31. The use of pictures in teaching.
32. Colonization.
33. Some uses of the electric telegraph.
34. A Court of Justice.
35. Emigration.
36. The snowstorm in March 1891.
37. Fruit trees.
38. The Census.
39. A general election.
40. The contents of any interesting book recently read.

For the years 1881–85 the candidate had a choice of one out of four; for 1886–91 one out of three; and the last year one out of only three.

For the last eight years Paraphrasing has been invariably set, as well as some etymological question.

Explanations or definitions of grammatical terms have been required during six of the past twelve years; queries on History of English and on the verb during five years each; on English Literature, classification of the various parts of speech and correction of sentences, for four years each; and upon Inflection on three occasions.

There have been also inquiries respecting the different uses of *what*, *that*, *but*, the use of the Vocal Noun versus Participle, of Conjunction versus Preposition, of Conjunction versus Relative Pronoun, and of *shall* versus *will*.

Passive, Infinitive, Defective, Auxiliary, Irregular Verbs have all been utilised, and the less common uses of the different cases have had to be explained. The English requirements of the Code, Adjectives not able to be compared, Position of Preposition, Spelling Rules, and Figures of Speech have all been to the front.

The sentences to be corrected (if necessary) are as follows :—

1. How sweet the moonlight sleeps upon this bank !
2. I am sorry to differ with you.
3. He is averse to the proposal.
4. For thou art a girl as much brighter than her
   As he is a poet sublimer than me.
5. These are the two persons whom he thought were away.
6. This England never did, nor never shall,
   Lie at the proud foot of a conqueror.
7. I never remember to have seen him before.
8. They deserve to receive condign punishment.
9. Please to send either a written or a verbal reply.
10. I intended to have pointed this out yesterday.
11. He hoped everyone had enjoyed themselves.
12. The climate is as good, or even better, than that of Madeira.
13. I should have liked to have seen so fine a sight.
14. I do not think him a reliable person.
15. There let him lay.
16. Preferring to know the worst than to dream the best.
17. The courage of the soldier and of the citizen are essentially different.
18. Each thought of others rather than themselves.
19. The orator spoke of the notion that the National Debt might be repudiated with absolute contempt.
20. Neither she nor James were there.
21. Either Mary or James must fetch me their rake.
22. Scott's 'Tales of a Grandfather' were written for his grandchildren.

VI. Requested Solutions.

(*a*) We are always pleased if in any way we can oblige our numerous correspondents by complying with their suggestions, but generally our space will not permit the insertion of solutions to problems that are not of general interest.

(*b*) It is between two and three o'clock, but a person looking at his watch mistakes the hour and the minute hand, so that he thinks the time of day fifty-five minutes earlier than in reality. What is the actual time?

He thinks it to be an hour earlier and five minutes later. There must, therefore, be five minute spaces between the hands. Now at two o'clock there were ten minute spaces intervening, so that the minute hand has gained five minutes upon the hour hand since two o'clock.

The problem now is :—

'How long will it take the minute hand to gain five minutes upon the hour hand?' And as the minute hand gains fifty-five minutes in an hour, the answer will be $\frac{1}{11}$ hours or $5\frac{5}{11}$ minutes past two.

(*c*) Write down the smallest fraction which, when reduced to a decimal, will give three non-recurring figures with a possible 60 figures and not more than 60 recurring.

For the fraction to be smallest possible, the three non-recurring figures must be three noughts, and there cannot be 60 recurring figures without the denominator being 61. Therefore, the total denominator will be 61,000, and of course the smallest fraction will be $\frac{1}{61000}$ answer.

Algebra, etc.

(*d*) A dealer *bought* a number of calves for £80. If each had cost him £1 *less*, and he bought 4 *more*, the total price would have been the same. How many did he buy?

Let x in £ = number of calves bought.

Then $\frac{80}{x}$ = price per calf.

$x+4$ = hypothetical number of calves bought.

$\therefore \frac{80}{x+4}$ = hypothetical price of each calf.

But $\frac{80}{x} - 1$ also = hypothetical price of each calf.

$$\therefore \frac{80}{x+4} = \frac{80}{x} - 1 = \frac{80-x}{x};$$

$$\therefore 80x = -x^2 + 76x + 320;$$

$$\therefore x^2 + 4x - 320 = 0;$$

$$(x+20)(x-16) = 0;$$

$$\therefore x + 20 = 0; \text{ and}$$

$$x - 16 = 0;$$

$$\therefore x = 16, \text{ or } -20.$$

Ans. 16.

The minus value (— 20) is inadmissible, but what does it signify?

Let us conventionally assume that buying is a minus or negative kind of selling, and that less is a minus—'more,' and more a minus—'less,' and then in the original question in 'order to satisfy the—20 value' change the above terms, forming a new but very closely related question as follows :—

(*e*) A dealer *sold* a number of calves for £80. If each calf had *brought* him £1 *more*, and he had sold 4 *less*, the price would have been the same. How many did he buy?

Let x in £ = number of calves sold.

Then $\frac{80}{x}$ = price per calf.

$x-4$ = hypothetical number of calves.

$\frac{80}{x-4}$ = hypothetical price of each calf.

But $\frac{80}{x} + 1$ also = hypothetical price of each calf.

$$\therefore \frac{80}{x-4} = \frac{80}{x} + 1 = \frac{80+x}{x};$$

$$\therefore 80x = x^2 + 76x - 320;$$

$$x^2 - 4x - 320 = 0;$$

$$(x-20)(x+16) = 0;$$

$$x = 20, \text{ or } -16.$$

Ans. 20.

VII. Typical Examples of Algebra.

(*a*) *Multiplication.*—1882. Express algebraically :—

The fourth power of the sum of two numbers, together with twice the product of their squares, is equal to the sum of their fourth powers, together with four times the product of their product, and the square of their sum.

1881. $(1 - x^2 + x^4 - x^6)(1 + x^2)$. Ans. $1 - x^8$.

1892. Show that the product of any four consecutive numbers increased by one is a perfect square.

1887. Prove that $(1+x)(1+y) - xy(1-x)(1-y)$ contains $1 + xy$ as a factor. Find the other factor.

Ans. $1 + x + y - xy$.

1888. Determine c and d so that in the product of $x^2 + x + 1$ and $x^3 + cx + dx + e$, the coefficients of x^4 and x^3 may vanish.

Ans. $c = -1$ and $d = 0$.

(*b*) *Division.*—1889. Divide $2x^4 + 12x^3 + 26x^2 + 24x + 8$ by $x^2 + 3x + 2$. Ans. $2(x^2 + 3x + 2)$.

1882. Prove that the difference between the cube of the sum of any two numbers, and the sum of their cubes is divisible by three times their product.

1887. Divide $\frac{1}{4}a^3 + \frac{3}{4}a^2x - 2x^3$ by $\frac{1}{2}a + x$.
Ans. $a^2 + ax - 2x^2$.

1884. Divide $7x^2 - \frac{1}{7}$ by $x + \frac{1}{7}$. Ans. $7x - 1$.

1881. What is the condition that $x^2 + px + q$ may be divided by $x - r$?
Ans. $r = \frac{-p \pm \sqrt{p^2 - 4q}}{2}$.

(c) *Factors.*

Break into factors :—

1889. $21x^2 - 40x - 21$. Ans. $(7x + 3)(3x - 7)$.
$143x^2 + 8x - 16$. Ans. $(13x - 4)(11x + 4)$.
$x^3 - 2x^2 + 2x - 1$. Ans. $(x - 1)(x^2 - x + 1)$.
1884. $x^2 + 3x - 10$. Ans. $(x + 5)(x - 2)$.
$9x^2 + 15x - 14$. Ans. $(3x + 7)(3x - 2)$.
1883. $(x^4 - 1)$. Ans. $(x^2 + 1)(x + 1)(x - 1)$.
$x^3 - x - 12$. Ans. $(x + 3)(x - 4)$.
1885. $x^8 - y^8$. Ans. $(x^4 + y^4)(x^2 + y)(x + y)(x - y)$.
$x^3 - 3x^2 + 3x - 1$. Ans. $(x - 1)(x^2 - 2x + 1)$.
$x^2 + 8x - 105$. Ans. $(x + 15)(x - 7)$.

VIII. Mensuration of Rectangles.

(1.) A cottage which stands on a square plot of 729 feet, contains four rooms of equal size on the ground floor, and is divided into two equal parts by a passage 4 feet wide, having two rooms on each side. Allowing 1 foot for the thickness of each wall, find the area of each of the four rooms. (1881.)
Ans. 114 sq. ft.

(2.) The area of a chess-board which contains 64 equal squares and an outer rim an inch wide, is 134·56 sq. ins. Find the side of each square.
Find also the width of the outer rim of another board of the same size, in which the area of each square is 1·361 sq. ins. (1882.) Ans. 1·2 ins. ; 1·13 ins.

(3.) If 15 trees can be planted on two square chains of ground, how many can be planted in a rectangular area 1,210 yards in length and 2,244 yards in depth? (1883.) Ans. 42,075.

(i.) *Quadrilaterals, Parallelograms, etc.*

(4.) The longer diagonal of a rhombus is 1,014 feet, the length of a side is 845 feet. Find the area of the rhombus and the length of the shorter diagonal. (1883.)
Ans. 685,464 sq. ft. ; 1,352 ft.

(5.) Find the length of the side of a parallelogram, one angle being half a right-angle, the altitude being equal to half the base, and the area containing 1,250 square feet. (1884.)
Ans. 50 ft., and $25\sqrt{2}$ ft.

(6.) Two adjacent sides of a field are at right-angles, and their lengths are 78 and 104 yards respectively. The other two sides form with a diagonal an equilateral triangle. Find the area of the field. (1886.) Ans. 11,373·7 sq. yds.

(7.) The sides of a field ABCD, taken in order, are 28, 45, 60, and 57 yards ; the angle ABC is a right-angle. Find the area of the field in square yards. (1888.)
Ans. 2,009·6 sq. yds.

(8.) The sides of a quadrilateral are 51, 140, 148, 149 feet respectively, and the angle between the first two is a right-angle. Find the area. (1891.) Ans. 13,140·05 sq. ft.

(9.) A quadrilateral field has two sides parallel to one another, whose lengths are 8 chains 15 links and 10 chains 5 links, and the perpendicular distance between them is 6 chains. Find the area, and the rent of the field at £2 5s. per acre. (1893.) Ans. 5·46 acres ; £12 5s. 8·4d.

(ii.) *Triangles, etc.*

(10.) A triangular space whose sides are in the ratio 5 : 5 : 6 contains 588 square yards. Find the length of its sides. (1881.)
Ans. 35, 35, 42 yards.

(11.) The three sides of a triangle are in the ratio of 4 : 5 : 7 and their sum equals 32 yards. Find the area of the triangle in yards. (1882.) Ans. 39·19 sq. yds.

(12.) Show that the area of a triangle whose sides are in the ratio of 3 : 3 : 4 is greater than $\frac{1}{3}$ of the area of a square described on one of the shorter sides. (1884.)
Ans. Area of triangle is to $\frac{1}{3}$ of area of square :: $\sqrt{5}$: 2.

(13.) The sum of the sides of a triangle is 24 feet. One side is 8 feet long, and the area of the triangle is 24 square feet. Find the length of the other two sides. (1885.)
Ans. 10 ft. ; 6 ft.

(14.) Find the cost of painting a dog-kennel 5 feet long, 2 feet wide, each side being 2 feet high, and the perpendicular height of the ridge of the roof from the ground being 3 feet 4 inches at 3d. per square foot. (1885.) Ans. 9s. 5d.

(15.) Show that the area of a triangle whose sides are 26, 35, 51, is the same as the area of a right-angle triangle whose sides about the right-angle are 7 and 120. (1889.)
Ans. 420 each.

(16.) The sides of a triangle are in the ratio of 13, 13, and 10. The area is 3,840 square yards. Find the length of each side. (1890.) Ans. 104, 104, 80.

(17.) Find the acreage of a triangular field whose sides are 2,170, 4,040, and 4,950 links. (1892.) Ans. 355$\frac{1}{4}$ acres.

(iii.) *Circles, etc.* (N.B. $\pi = \frac{22}{7}$).

(18.) The length of each side of a square piece of thin metal is 4 feet, and lines are drawn parallel to each side dividing it into 9 equal squares, out of each of which the inscribed circle is punched. If the value of the whole piece of metal be £14, what is the value of these circular discs? (1886.)
Ans. £10 19s. 10·9d.

(19.) In a rectangular garden, 40 yards long, 30 yards wide, a path 5 feet wide is made running round the sides, and there are four circular flower-beds, each 28 feet in diameter. How much will it cost to cover the rest of the space with grass at 7½d. per square yard? (1887.) Ans. £22.

(20.) A circle and an equilateral triangle have the same perimeter ; compare their areas. (1887.)
Ans. Area of circle : Area of triangle :: 21 $\sqrt{3}$: 22.

(21.) The area of a circle is 38·5 square feet. Find the area of a square whose perimeter is equal to the circumference of the circle. (1888.) Ans. 30¼ sq. ft.

(22.) The circumference of a circular field is 252 yards. If the field be worth £48·16s., find the value of a similar circular field whose circumference is 315 yards. (1889.)
Ans. £76 5s.

(23.) The diameters of the wheels of a bicycle are 48 and 14 inches respectively. Find how many revolutions the smaller wheel will make more than the large wheel in a distance of 10 miles. (1890.) Ans. 10,200.

(24.) The circumference of a circular reservoir is 553$\frac{1}{7}$ yards, and the area that it occupies on a map is $\frac{1}{12}\frac{1}{5}$ of a square inch. Find the scale on which the map is drawn measured by inches per mile. (1891.) Ans. 10 inches.

(25.) The rectangular frame of a circular mirror is 5$\frac{1}{2}$ feet long, and 3$\frac{1}{2}$ feet broad. Find the radius of the mirror when its area is equal to that of the frame. (1892.) Ans. 1$\frac{3}{4}$ ft.

(26.) The area of the space between two concentric circles is 1,078 square feet. The radius of the larger circle is 28 feet. Find the radius of the inner circle. (1893.) Ans. 21 ft.

IX. Notes on Euclid.

Signs and contractions allowed by Department.

(a) *Allowed by Department.*

= means *equal to*, or *equals*
$>$,, *angle*
rt.$>$,, *right angle*
$\angle ABC$,, *angle ABC*

,, *angle ABC*
⊥r ,, *perpendicular*
$\triangle$,, *triangle*
rt.$>$d. $\triangle$,, *right-angled triangle*
Equil. $\triangle$,, *equilateral triangle*
Isos. $\triangle$,, *isosceles triangle*
str. ,, *straight*
$\parallel$,, *parallel*, or *parallel to*

▱	means	*parallelogram*
sq.	,,	*square*
rect.	,,	*rectangle*
⊙	,,	*circle*
circn. of ⊙	,,	*circumference of circle*
∴	,,	*therefore*
∵	,,	*because*

(*b*) *Not allowed by Department.*

>	means	*greater than*
<	,,	*less than*
≯	,,	*not greater than*
≮	,,	*not less than*
AB^2	,,	*sq. on AB*
AB.BC	,,	*rect. contained by AB and BC*
AB+BC	,,	*sum of AB and BC*
AB—BC	,,	*difference of AB and BC*
AB×BC	,,	*product of AB and BC*
AB÷BC	,,	*quotient of AB divided by BC*
$\frac{AB}{BC}$	,,	*quotient of AB divided by BC*

The RULE is that ANY *descriptive* abbreviations of TERMS may be used, but not *ambiguous* ones (*e.g.*, <= *less than*), nor may signs of arithmetical OPERATIONS be employed.

Neither figures, manuscript capitals, nor the leading letters of the alphabet may be applied to the diagrams, but such characters as M, N, O, P, Q, R, etc.

X. Model Answers to Domestic Economy.

Section I.

1. (1) Discuss the advantages of preparing meat by stewing, and say (2) what portions of beef and mutton are best so treated.

(1) The advantages of preparing meat by stewing are :—

(*a*) *It is least wasteful and most economical.*

Every particle of meat is made wholesome, and the nutritive juices which escape are utilised in the soup. The nourishment from bones can be extracted by long stewing.

(*b*) *Little labour is required.*

Tough or sinewy portions of the meat may be placed in the stewpan and left to simmer gently for hours.

(*c*) *Fuel is saved.*

Only a moderate fire is needed, as a hot fire would toughen the meat.

(*d*) *Savoury dishes may be made at a small cost.*

(2) The portions of beef which are best stewed are—the leanest parts of flat ribs, shoulder, neck, brisket, and any part of the shin or leg. The parts of mutton best suited for stewing are neck, breast, shank, and head.

2. (*a*) What is the function of yeast in the making of bread? (*b*) Discuss the merits of white and brown bread respectively.

(*a*) The function of yeast in the making of bread is *aëration*. At a warm temperature the yeast plant commences to grow, and during its growth gives off carbonic acid gas, which, in its endeavour to escape through the glutinous mass of dough into which it has been introduced, forms innumerable bubbles and expands the whole mass of dough, making it light and spongy. When this is placed in the oven and subjected to a greater heat, the holes become fixed in shape and size and the bread *light*.

(*b*) In real brown or whole-meal bread all the nutrients of the grain will be present, the albuminoids, the oil or fat, and the mineral matters, existing in larger proportion than in bread made from fine white or even seconds flour.

Brown or whole-meal bread thus furnishes more nourishment than white bread, and is, therefore, more suitable to poorer families where flesh-meat is the exception rather than the rule ; brown bread is also more nourishing for young children, who ought not to eat much flesh-meat.

Brown bread is also less liable to adulteration than white bread. White bread is suitable to persons living in luxury, to whom a great variety of food stuffs, animal as well as vegetable, are accessible, but does nor contain nearly as much nourishment as brown bread.

3. Should children eat much or little fruit? Discuss the general value of fruit as food.

Fruit is undoubtedly an excellent addition to a child's diet, because of its blood-purifying qualities. On no account should uncooked or unripe fruit be carelessly and indiscriminately used ; but ripe fruit in its proper season, and well-cooked fruits, whether fresh or dry, may with advantage be taken by children at most meals. As a food, fruits are of little value, as they contain only a very small amount of nitrogenous matter. They are chiefly warmth producing, as they contain carbonaceous compounds. Figs, dates, bananas are of more use as food than apples, pears, etc.

Section II.

1. What articles of clothing would you think necessary for a well-clad girl of five years of age attending school in winter? Of what materials should they be made, and what would be the approximate cost of each article?

	s.	d.
Vest (knitted or flannel), ¼ lb. of wool or 1 yd. of flannel	1	0
Chemise of calico, 1 yd. at 5d.		5
Crotchet edging, cotton, 1d.		1
Corded bodice	1	3
Drawers, 1 yd. of calico at 5d., or 1 yd. of flannelette		6
If calico, crotchet edging, 1d.		1
Flannel petticoat, ¾ yd. flannel at 1s., ½ yd. calico at 5d., buttons ½d.	1	0
Princess robe shaped top skirt, cloth, wincey, or other warm material, 1½ yds. (single width) at 10d.	1	3
Dress, 2 yds. of Egerton and Burnett's serge, double width, at 2s. 3d. (or like material)	4	6
Warm jacket or coat	4	6
Woollen hood or hat	2	6
Pair of woollen gloves		7

2. Enumerate with reasons the point in which present fashions in women's dress appear to you to violate known laws of health.

The waist is often compressed by corsets which have whalebone, steel, or cane in them.

The most vital parts of the body, the liver, lungs, heart, kidneys, etc., lie around the waist ; these are forced somewhat out of place, and in their turn displace some other organ, so that the shoulders are forced up and the digestive organs are impeded.

The head is often loaded with pads and false hair which overheat the head, thereby causing headache and spoiling the natural hair.

Tight, high collars place the head and neck in a constrained and unnatural position, and may injure the spine.

The high heels and narrow toes of the fashionable boots, which are worn to give the foot a small appearance, are the originators of corns and bunions. Injury to the spine often arises from high heels, because of the tendency to throw the body forward.

The evening dresses worn by ladies of the present day expose the chest and throat, and are therefore conducive to diseases of those organs.

3. Explain the process of washing (*a*) flannel garments, and (*b*) coloured cotton garments, giving reasons in each case.

(*a*) For the washing of flannel garments a soap-jelly must be made, and the water must only be tepid. On no account must the water be hot, or the flannels will shrink and become hard.

The flannels must be kneaded in the water in which the soap-jelly has been melted ; they must not be rubbed, or they will shrink. A second lather will most likely be required ; they should then be rinsed in clean lukewarm water, wrung, shaken well, and hung out immediately.

It is better, if possible, to take each article through all the above processes separately.

Another help to prevent them shrinking is *pulling them out well on the line* while they are drying.

(*b*) Coloured cotton garments should be washed in lukewarm water as quickly as possible, and, like the flannels, one at a time quite finished ; especially if the colours are not fast, or are doubtful. When they are quite clean, put them through cold water in which has been dissolved some salt, or, better still, some powdered alum ; these articles set and harden the dye. Hang them out to dry as quickly as possible, keeping them out of the sun if it is very strong, to prevent fading.

Section III.

1. Presuming that you are likely to be dependent on yourself for your living all through your life, by what means could you forthwith begin to make provision for old age?

The safest plan is to invest in a Government Annuity. Immediate or Deferred Annuities, not exceeding £100 receivable half-yearly, may be purchased through the medium of the Post Office Savings Bank, on the lives of persons of either sex. For a cash sum of £24 16s. 6d., paid by a woman twenty years of age, she will receive 10s. every half-year for the remainder of her life.

Deferred Annuities, payable after the expiration of an agreed number of years, not less than 10 nor greater than 50 from the date of the contract, may be purchased by a single or annual payment.

2. Three sisters, aged severally twenty-five, eighteen, and sixteen, have to live on a joint income of £150 a year. For what purposes and in what amounts would the money be best used?

	£
Rent - - - -	15
Gas, Fuel, Miscellaneous household expenses - - - -	15
Food - - - -	50
Clothes - - - -	25
Savings - - - -	20
Benevolence - - -	8
Books - - - -	5
Holidays, Amusements, etc. -	12
Total	£150

Section IV.

1. By what means would you endeavour to *prevent* in young children (*a*) ear-ache, (*b*) toothache, and (*c*) rheumatism?

(*a*) *Ear-ache* may be prevented in young children by keeping the ears perfectly clean and free from wax.

The child should on no account be allowed to take cold, and wool should not be placed in the ear unless by the doctor's order.

Ear-ache is often caused by decayed teeth, which should be at once extracted.

(*b*) *Tooth-ache* in young children often arises from eating too many sweets, etc. Children should, therefore, not be allowed to eat sweets at their own will.

Care should also be taken that children do not take cold. They should be kept out of draughts. The teeth should be kept regularly clean, and the dentist should be visited occasionally.

(*c*) *Rheumatism* may be prevented in young children by taking care that long sleeves and stockings are worn. They should be kept out of draughts, and great care should be taken to prevent damp clothing, damp beds, and cold and damp feet.

2. If you were lodged in a bed-room which you had not used before, and you could not rely on the people of the house for proper judgment in matters relating to health, how would you proceed to secure yourself against their possible ignorance?

(1) Care should be taken that the chimney is not blocked up.

(2) The window must be one that may be thrown wide open during the day.

(3) The bed must not be placed too near the door, window, or fireplace.

(4) All the bed-linen must be aired. The first night, sleep between the blankets.

3. What would you do in the following cases of accident in school:—(*a*) a cut finger, (*b*) an epileptic fit, (*c*) nose bleeding, and (*d*) scalding?

(*a*) In the case of a cut finger, well wash the wound to clear away any dirt, draw the edges together and keep in position by a few strips of sticking plaster. This should be covered by a bandage to exclude the air, and kept unopened until the cut is closed.

(*b*) In the case of an epileptic fit, the patient should be laid on his back with his head slightly raised. Pressure on the throat must be prevented by loosening the clothing, and a cork or india-rubber rug should be placed between the teeth. Plenty of fresh air should be admitted, and the patient should be incessantly watched lest he should hurt himself in any way. The rest of the treatment should be left to the doctor.

(*c*) In the case of nose bleeding, the patient should be slightly inclined, and cold water held to the nose. On no account must keys or any other cold article be placed down the back, or the blood will congeal.

(*d*) In the case of a scald, the clothes must be cut off very gently, and the greatest care must be taken to prevent the skin from breaking. If there is only redness of the skin, cover with flour to exclude the air. Never apply cold water. If the skin is covered with blisters, apply lint covered with olive oil or lime-water. Two days afterwards prick the blisters to let the fluid escape, but on no account remove the skin. Healing ointment must now be employed.

SELECTED GOVERNMENT QUESTIONS.

First Week.

Men.

EUCLID.

1. Define *plane rectilineal angle, circle, obtuse-angled triangle, parallelogram, axiom, converse proposition, gnomon.*

On the same base, and on the same side of it, there cannot be two triangles that have their sides which are terminated at one extremity of the base equal to one another, and at the same time those which are terminated at the other extremity equal to one another.

2. Any two sides of a triangle are together greater than the third side.

The sum of the diagonals of a quadrilateral is less than the sum of any four lines that can be drawn from any point (except from the intersection of the diagonals) to the four angles.

3. The opposite sides and angles of a parallelogram are equal to one another, and the diameter bisects it, that is, divides it into two equal parts.

The line which joins the middle points of the oblique sides of a quadrilateral, two of whose sides are parallel, is equal to half the sum of the two parallel sides.

4. In every triangle, the square on the side subtending an acute angle is less than the squares on the sides containing that angle by twice the rectangle contained by either of these sides, and the straight line intercepted between the perpendicular let fall on it from the opposite angle, and the acute angle.

If ABC be a triangle in which C is a right angle, and DE be drawn from a point D in AC at right angles to AB; prove that the rectangles AB. AE, and AC. AD will be equal.

ALGEBRA.

5. Prove that

$$(x+y+z)^3-6xyz=(x+y)^3+(y+z)^3+(z+x)^3-x^3-y^3-z^3.$$

Find the greatest common measure of

$$x^3-3x^2+4x-2 \text{ and } x^3+2x^2-4x+1.$$

6. Prove that $\frac{a}{b}\div\frac{c}{d}=\frac{ad}{bc}$, where the letters denote *any* numbers.

Simplify $\left(\dfrac{a+\frac{b^3}{a}}{a+\frac{b^2}{a-\frac{b^3}{a}}}\right)\div\dfrac{1-\frac{a}{b}}{1-\frac{a^2}{b^2}}$

7. Solve the equations

(1) $\dfrac{9}{x+1}-\dfrac{3(x-1)}{x-2}+\dfrac{3x}{x+2}=0.$

(2) $\left.\begin{aligned} x+\frac{y}{11}&=71\\ y-\frac{x}{13}&=61\end{aligned}\right\}$

(3) $x-\dfrac{5}{2}+\dfrac{1}{x-\frac{5}{2}}=x-1+\dfrac{1}{x-1}.$

8. A farmer holds two farms, for each of which he pays a rent of 32 shillings an acre, the total rent being £432. The value of the land falling, the rent of the smaller farm was reduced 2 shillings, and of the other 7 shillings per acre, and his total rent was reduced by £64 10s. Find the number of acres in each farm.

9. A tradesman started in business with a capital of £1,200, and in the first year he makes a certain percentage of profits, from which he takes £164, and adds the rest to his capital. In the next year he makes the same percentage of profits, and having again withdrawn £164, finds he has £1,422 left in the business. What percentage of profit did he make?

MENSURATION.

10. The sides of a quadrilateral are 51, 140, 148, 149 feet respectively, and the angle between the first two is a right angle. Find the area to two places of decimals.

11. The circumference of a circular reservoir is 553½ yards, and the area that it occupies on a map is 11½ square inches; find the scale on which the map is drawn, measured by inches per mile.

$$\left(\pi = \frac{22}{7}\right)$$

ANSWERS.

For Euclid Hints on Questions 1 to 5, *see infra.*

(5) $x - 1$.

(6) $\frac{b}{a}$.

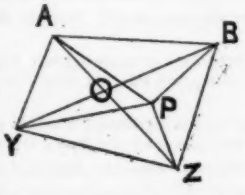
(7) $x = -10$; $y = 66$, $x = 65$; $y = 2$ or $-\frac{1}{2}$, $x = 3$ or $\frac{1}{2}$.

(8) 120 acres and 150 acres.

(9) 22 per cent.

(10) 13,140·050 . . . . sq. feet.

(11) 10 ins. per mile.



EUCLID SOLUTION HINTS, Questions 2, 3, 4.

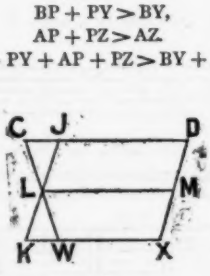
Question 2.

$BP + PY > BY$,

$AP + PZ > AZ$.

$\therefore BP + PY + AP + PZ > BY + AZ$, etc.

Q.E.D.



Question 3.

Let CWXD be the quadrilateral.

Through L draw JLK ∥ DMX.

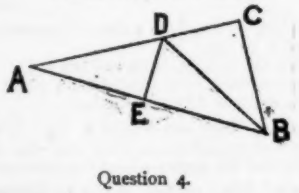
Then $\triangle$s CJL, JCL and side CL = $\triangle$s WKL, KWL and side WL.

Then side JC = side KW;

$\therefore DC + WX = DJ + KX$;

but $ML = \frac{1}{2}(DJ + KX)$;

$\therefore ML = \frac{1}{2}(DC + WX)$. Q.E.D.



Question 4.

$AE^2 + BE^2 + 2BE.EA = AC^2 + BC^2$.

" " " $= AD^2 + DC^2 + BC^2 + 2AD.DC$.

" " " $= AD^2 + BD^2 + 2AD.DC$.

" " " $= AD^2 + DE^2 + BE^2 + 2AD.DC$.

$AE^2 + 2BE.EA = AD^2 + DE^2 + 2AD.DC$.

$2AE^2 + 2BE.EA = AD^2 + AD^2 + 2AD.DC$.

$2BA.AE = 2AD.DC$.

$BA.AE = AD.DC$. Q.E.D.

Women.

1. A useful outfit has to be provided for a school girl 14 years of age who is going into domestic service as a nursemaid. State what garments you would give her, the kind and amount of materials to be used in each garment, and the cost (in detail) of the outfit.

2. By what means could you make worn sheets and table cloths fit for further use, or how could you otherwise utilise them?

3. Give the reasons for and against the use of a sewing machine in a household.

4. The food stuffs on which man subsists may be divided into two well-marked groups, Nitrogenous and Non-Nitrogenous. Explain what this means, and why these terms are used.

5. What is the most economical mode of cooking meat? Give your reasons, and describe the process.

6. Give a receipt for making a boiled batter-pudding, giving exact quantities, method of preparing, and time and manner of boiling.

7. What is the range of temperature for cold and hot baths respectively? What precautions are necessary in the fixing of a bath, as to filling, emptying, and overflow?

8. Supposing the clothes of a girl in your school took fire, describe accurately what you would do, and what you would not do. If you had to carry her home, how would you improvise a stretcher?

9. Describe, as fully as you can, the origin, preparation, and use of the two principal vegetable products used in this country for clothing.

10. Two teachers live together in the country, and have their washing-day once a fortnight. Describe how they would manage with the help of a girl of 14, remembering that their school duties must not be neglected.

SECOND WEEK.

1. Show by examples the different uses which may be made in English of the words *what* and *that*. Parse the sentence:

What seemed his head
The likeness of a kingly crown had on.

2. If you think there is anything wrong in any of the following sentences, correct it, and give your reasons:—

(*a*) I should have liked to have seen so fine a sight.
(*b*) I do not think him a reliable person.
(*c*) There let him lay.
(*d*) He preferred to know the worst than to dream the best.
(*e*) The courage of the soldier and of the citizen are essentially different.
(*f*) Each thought of others rather than of themselves.

3. Draw a map of the Irish Sea.

4. State briefly what is meant by constant winds and ocean currents. The Gulf Stream is said to influence the climate of these islands. How would you explain this?

5. What is the use of '*Learning by heart*'? Name some things which ought and others which ought not to be so learned. Give your reasons.

6. What sort of sketch should appear on the blackboard at the end of a collective lesson on the Ocean? What is the best use to make of such a sketch after it is written.

7. Arrange in chronological order and give the dates of the following events:—Execution of Mary, Creçy, Flodden, Boyne, Deaths of Knut and Henry VIII., the introduction of printing, the peace of Amiens, the peace of Ryswick, Abolition of the Slave Trade, Magna Charta, Solemn League and Covenant.

8. Write short accounts of Raleigh, Hampden and Falkland.

9. Write any form of the scale of B minor, ascending and descending.

(*For Sol-faists.*) Name (1) the minor sixth and (2) the major seventh of the Lah or minor mode.

10. 684 policemen are to be distributed among three towns in proportion to their population—viz., 10,944, 12,312, 25,992. How many will be sent to each town? Ans. 152, 171, 361.

11. (*a*) Prove the rule for finding the vulgar fraction equivalent to ·2̇7̇. Ans. $\frac{3}{11}$.

(*b*) Define *ratio, proportion, interest and discount.*

12. Give the equivalents of the following decimal expressions in English money; and of the following sums of money in decimals of a £:—

(*a*) £16·25; £1·025; £7·16; £2,034·875.
Ans. £16 5s. 0d.; £1 0s. 6d.; £7 3s. 4d.; £2,034 17s. 6d.

(*b*) £2 12s. 6d.; £134 10s.; 7s. 6d.; £1 1s. 0d.
Ans. £2·625; £134·5; £·375; £1·05.

13. (*Men only.*) Any two sides of a triangle are greater than the third side.

AB bisects CD at right angles at B; P is a point within the angle ABC, and CP produced cuts AB at E. Show that the difference between ED and EP is greater than that between any other two lines drawn from P and D to meet AB.

(*Women only.*) On what grounds can a diet consisting wholly of vegetable food be defended? What objections to it can be fairly urged, and to persons of what class or age are such objections applicable?

14. (*Men only.*) Write out Euclid I. 29.

P is a point between two given parallel straight lines, such that any two straight lines drawn through P always intercept equal portions of the parallel straight lines. Show that P is equidistant from the parallels.

(*Women only.*) Describe fully the process of making bread, the materials to be employed, the time to be occupied in the process, and the appliances needed.

15. (*Men only.*) Show that the arc of a triangle, whose sides are 26, 35, 51, is the same as the area of a right-angled triangle whose sides about the right angle are 7 and 120. Ans. 420 each.

(*Women only.*) What are the special advantages of fish as an article of food?

16. (*Men only.*) Solve $\frac{m}{n}+\frac{n}{y}=1$; $\frac{n}{x}+\frac{m}{y}=1$.
Ans. $x=y=m+n$.

17. (*Men only.*) Solve
$$5x-6y+4z=15$$
$$7x+4y-3z=19$$
$$2x+y+6z=46$$
Ans. $x=3$; $y=4$; $z=6$.

Third Week.

1. What is a Criticism Lesson? Under the head of 'Discipline' what points would you attend to in such a lesson?

2. Write notes of a lesson on *one* of these subjects:—
(*a*) The commercial importance of the Rhine, Vistula, and Danube.
(*b*) Cardinal Wolsey.
(*c*) Interest of money.
(*d*) Sugar. (*Infants.*)

3. In giving a lesson on the Duke of Wellington, show what use you would make of comparison and contrast with any other character in history.

4. What rules have you learned to observe in giving out Dictation?

5. After a class has reproduced in writing a short story which you have previously read to them, what is your method of revising the exercises?

6. Give some hints for making oral exercises in Arithmetic interesting.

7. Give a short list of the different kinds of books which you would expect ordinary boys and girls to be able to read by themselves immediately after quitting the day school, say at the age of 13. Mention some good books which you think are rather too difficult for such children.

8. In preparing a lesson upon a comparison between the present condition of Great Britain and that of France, Germany, *or* the United States, state what classes of facts you would wish to procure, and in what books you would seek them. Give an example of a sketch which would exhibit your facts in tabular form on the black board.

9. In what ways may success in class teaching be promoted by studying the characters of children?

10. Explain any way you know of making clear to the eye the process called multiplying $\frac{2}{3}$ by $\frac{1}{2}$.

11. After explaining to a class the effect of mountain ranges upon climate, show how you might lead the children to seek further proofs for themselves.

12. What is an Object Lesson? Show that mere sight is not necessarily knowledge.

13. In giving a lesson on a river, which is the better plan, to speak first of a particular river which the children have seen, or to start with a definition and a general description? Give reasons for your opinion.

14. Describe the best method of proceeding in teaching a new song to infants or to older children.

Fourth Week.

1. Write a letter descriptive of the town or village in which you live, or of any famous building in or near it.

2. Give examples of English words in which differences of (*a*) Case, (*b*) Number, (*c*) Gender, (*d*) Degree, (*e*) Mood, (*f*) Tense, (*g*) Voice are indicated by changes in the word itself.

3. Draw a map of New Zealand.

4. In what part of the British Isles are there to be found *lead, slate, granite, building-stone, peat, china clay,* and *medicinal springs.* Give names and describe positions as accurately as you can.

5. How are the seasons caused? Explain the phenomenon of twilight.

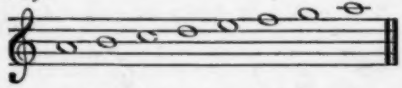
6. Arrange in chronological order (giving the dates, if you can) ten battles fought on English soil, not mentioning more than one of any given series.

7. Mention some of the particulars in which you think great progress of any kind has been made during the reign of Her Majesty.

8. Write full notes of a lesson on a flour-mill *or* a steam-engine.

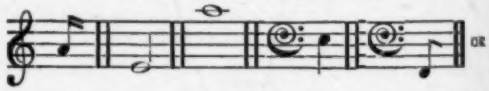
9. Draw a plan of the schoolroom with which you are most familiar, showing the position and relative sizes of desks and gallery. Explain the advantages and disadvantages of the arrangement.

10. Complete the following as a scale of A, and write out the scale of B♭.



Write a scale in the *Lah* mode, and one in the *Ray* mode.

11. Write the pitch names and duration names of the following notes, and also the signs for rests of corresponding value:—



Re-write the following, (*a*) doubling and (*b*) halving the value of every note and rest:—

| s :— | :r | m :—.d | r .d : t, .d ‖

12. (*Men only.*) Subtract the number whose square root is ·01 from the number whose square is ·01871424. Ans. ·1367.

13. At what rate per cent. per annum (simple interest) will £1,350 amount to £1,621 13s. 9d. in 5 years 9 months?
Ans. 3½ per cent.

14. (*a*) Explain clearly, as to a class of beginners, the method of subtracting 206 from 302.
(*b*) Prove that the G.C.M. of 90 and 102 is 6.
(*c*) Prove that a fraction is divided by a whole number when its denominator is multiplied by that number.

15. (*Men only.*) Write out Euclid I. 13. If two right-angled triangles have their hypothenuses equal, and also one side equal to one side, prove that the angles opposite to the equal sides are equal.

(*Women only.*) What method should be adopted to teach little children to fix their own needlework? Would a different system be adopted in the upper classes?

16. (*Men only.*) Write out Euclid II. 7. Comprise Euclid II. 5 and II. 6 in one enunciation.

(*Women only.*) Give an account of the best mode of washing (*a*) a flannel waistcoat, and (*b*) a linen shirt.

17. (*Men only.*) The radius of a circle is 7 feet. From a point 12 feet from the centre a straight line is drawn to touch the circle. What is its length? Ans. 9·75 feet.

SCHOLARSHIP OR FOURTH YEAR ROUTINE FOR NOVEMBER, 1894 (MEN AND WOMEN).

DAYS	FIRST WEEK			SECOND WEEK			THIRD WEEK			FOURTH WEEK		
	I.	II.	III.	I.	II.	III.	I.	II.	III.	I.	II.	III.
MONDAY	Algebra up to Factors *or* Questions on Needlework	History from 1625 to 1640	Latin *or* French Grammar	H.C.F. of Algebra — Ingredients of Food	Dates to 1300	'La Jeune Sibérienne' *or* 'De Bello Gallico'	Algebraic Fractions *or* Rules of Health	Dates to 1600	Latin *or* French Grammar	Simple Equations *or* Miscellaneous Geography	Dates to 1894	'La Jeune Sibérienne' *or* 'De Bello Gallico'
TUESDAY	Props. 12 and 13 of Euclid, Book II., *or* Diagram of Night Shirt	Physical Geography of South America	Tables of Battles	Props. 14, 1 and 2 of Euclid, Book I., *or* Flannel Sampler	Revise Geography of Scotland	Chief English Poets	Props. 3 and 4 of Euclid, Book II., *or* Calico Sampler	Physical Geography of North America	Acts against abuses of Kingly Power	Props. 5, 6, and 7 of Euclid, Book II., *or* Diagram of Night Shirt	Revise Geography of Ireland	Tudor Dynasty
WEDNESDAY	Percentages and Repetition	History of English Language	Map of Scotland	Stocks	Paraphrasing and Repetition	French *or* Latin	Square Root	Table of English Literature	Map of New Zealand	$\frac{2}{4}$ $\frac{3}{4}$ $\frac{3}{4}$ $\frac{4}{4}$ Time *or* Remainder of First Year Tonic-Solfa	Latin Prefixes and Affixes	Latin *or* French
THURSDAY	H.C.F. (G.C.M.) of Algebra *or* Savings and Investments	History from 1640 to 1649	'La Jeune Sibérienne' *or* 'De Bello Gallico'	G.C.M. of Algebra *or* Preparation of Food	England under the Saxons	Latin *or* French Grammar	Algebraic Fractions *or* Clothing and Washing	England under Normans and Plantagenets	'La Jeune Sibérienne' *or* 'De Bello Gallico'	Simple Equations *or* Miscellaneous Geography	England under the York and Lancastrian Dynasties	Latin *or* French Grammar
FRIDAY	Revise Props. 32, to 48 of Euclid, Book I., *or* Calico Sampler	Political Geography of South America	Stocks	Deductions on Euclid, Book II., *or* Diagram of Night Shirt	Map of Canada	Mensuration of the Circle *or* Mixtures	Revise Props. 1 to 16 of Euclid, Book I., *or* Flannel Sampler	Political Geography of North America	Equation of Payments	Deductions on Euclid, Book II., *or* Any Needlework	The Seasons	Latin Roots and Repetition
SATURDAY	How to Teach Grammar to Standard V.	Parsing and Analysis	Examination	Notes of a Lesson on Standard VI. Geography	Study English Accidence from Text-book	Examination	The Major Scales and Signatures *or* Mental Effects of Notes. Removes of Key, Bridge Notes	Parsing and Analysis	Examination	Mensuration of Triangles *or* Square Root	Paraphrasing and Dictation	Examination

(*Women only.*) Describe the special uses of linen, cotton, wool, leather, and silk, for purposes of clothing.

18. (*Men only.*) In the quadratic equation $x^2 + ax + f = o$, show that the sum of the roots $= -a$, and the product of the roots $= f$.

19. (*Men only.*)
$$3x + 4y = 2xy$$
$$4y + 3z = 3yz$$
$$6z + 5x = 4zx$$
Ans. $x = 4,\ y = 3,\ z = 2$.

(*Women only.*) What special care should be taken by those attending a sick room, *both* as regards the sick person and themselves?

CORRESPONDENCE.

We shall be pleased to reply briefly through these columns to any SUBSCRIBER *seeking examinational information or advice, and* **Enclosing the Necessary Coupon.**

This privilege does not, of course, extend to furnishing the solutions and answers of problems. All such communications should be addressed to 'THE QUERY EDITOR.'

Replies demanding urgency will be promptly forwarded per post on the receipt of a stamped and addressed envelope, **Accompanied by the Requisite Coupon.**

A post will be saved by writing direct to GEORGE BEACH, STANLEY MOUNT, MACCLESFIELD.

R.B.N. (Chelmsford).—'Warren Hastings' is published by Macmillan, 'Men of Action' series, price 2s. 6d.

F.B. (——).—M.S. received.

F.R. (South Shields).—Lewis' edition of 'Bacon.'

U.N.C. (Hastings).—There cannot be triple check in Chess.

T.R. (Chelsea).—The N.U.T. is a non-political body. It is neither Home Rule nor Unionist; neither for nor against Voluntary as versus Board Schools.

PETITIO (Canterbury).—Far too many questions.

'T.C.' (Bolton).—The book must be duly filled up.

LEX (Oxford).—Write to Under-Treasurer, Middle Temple.

H.N. (Hull).—Our journal is the 'PRACTICAL TEACHER,' not '*Pratical*,' as you twice spell it.

R.T. (Boston).—Your Managers cannot compel you to stay till Christmas.

J.L. (Chatham).—The style is immaterial.

PARENT (Burton).—There is no need whatever to write to Department. See the Head-Master, who will arrange matters amicably.

A.E.B. (Bristol).—The A.I. had no right whatever to direct any particular style of letter to be taught. Loops are not generally taught for Large hand, although there is a growing inclination to assimilate the styles of Large and Small hand.

CRYCH (Newport).—(*a*) You will have no status until you pass. (*b*) You must arrange with H.M.I. to hear Recitation, etc.

A.J.F. (Francombe).—You will probably have to take those subjects. The practice has varied.

M.V. (Berwick).—From 'PRACTICAL TEACHER' Office, post free for 1s. 6d.

SOL (Nottingham).—Messrs. Macmillan's Certificate Series.

ANSWERED PER ORDINARY LETTER.—F.K. (Streatham Hill); H.V.J. (Ash Vale); J.S. (Gorleston); E.J.D. (Macclesfield); B.C.L. (Llangendeirne); E.A. (Old Goole); H.W.B. (Alnwick); L.C. (Old Trafford); E.B. (Lowestoft); A.M. (Milford); S.R.M. (Hull); A.L.M. (Topsham); E.H.C. (Scarning); E.N.D. (Newcastle); I.W. (Deal); W.H. (Crewe); H.N. (Romford); E.O.S. (Yaxley); M.T. (Harpurhey); E.B. (Bishop Auckland); M.J. (Llanfrynach); P.U.N. (Cork); A.R. (Newcastle); M.C. (Disley); C.F. (Ipswich); W.W.G. (Montrose); A.A.L. (Graham's Town); M.F.S. (Preston); A.G. (Arnold); H.W. (Woodstock); H.H. (Hoyland); T.H.H. (Londonderry); E.B. (Oldbury); S.S. (Aberystwyth); J.W. (——); W.L. (Sutton); T.J. (Old Mills); S.R. (Hilton); M.F. (Birkenhead); L.J. (Folkestone); J.S. (Derby); A.Y. (Heaton Moor); S.W. (Keldeston); J.C. (Marten); A.C. (Mill Hill); R.O. (Ashton); J.M. (Stand); A.K. (Chester); T.E.L. (Quarry Hill); F.S. (Alderley); J.C.A. (Cranford); J.A.P. (Hooten); E.A. (Uttoxeter); H.N. (Fallowfield); U.S. (Scotland Bridge); 'NUX' (Alfreston); F.S. (Pentrick); W.W. (Berwick); J.S. (Didsbury); H.M. (Bangor); S.L. (Stockport); E.J. (Blaenffos); F.W.G. (Dukinfield); F.H. (Grimsby); J.G. (Lockerbie); J.F.S. (Hockley); M.J. (Llanfrynach); F.W. (Westward Street); F.K. (Streatham Hill); G.W. (Frome); J.D. (Middleton); E.M.O. (Kerry); M.H. (Beverley); 'SCIENCE' (Abertillery); E.T. (Stoke Prior); E.L. (Gosport); J.D. (Ayr); S.C. (Ashbourne); E.S. (Farington); E.E.U. (Wantage); E.H.C. (Scarning); A.M.C. (Prestonkirk); M.T. (Great Salkeld); J.B. (Langley); A.B. (Cannock); A.P. (Atherstone); MISS WOOD (——); K.C. (Thurso); A.W.D. (Newcastle).

To the very numerous correspondents who have kindly informed us with encouraging appreciation of their Scholarship success, we tender our hearty thanks. We compliment them on the past results, and urge them to further achievements.

OUR 1894 CERTIFICATE CLASS.

BY GEORGE BEACH, M.A., LL.D. (DUBLIN),
Author of '*Elements of English*,' '*A Girls' Arithmetic*,' '*Entertaining Readers*,' etc.

I. BACON'S ANTITHETA.

Essay XXI.

For.	*Against.*
1. Fortune often sells to haste what she gives without price to delay.	1. Opportunity gives you first the jug's handle, but afterwards the belly.
2. While we hasten to clasp the beginnings of things we clutch at shadows.	2. Opportunity, like the Sibyl, lowers her offers and raises her prices.
3. While things are wavering, watch; when they turn, act.	3. Speed is the invisible cap, or the Helmet of Pluto.
4. In actions the beginnings should be intrusted to Argus of the hundred eves, but the ends to Briareus of the hundred hands.	4. When one acts betimes, one may act like a judge; but when one is late in action, one must act like a courtier.
5. Dangers more oft beguile than overpower.	5. One teaches danger to advantage by being always on the alert for it; and one makes to oneself imaginary perils by one's useless safeguards.
6. It is less troublesome to stop and front a danger, than to note and guard against its growth.	6. Even in safeguards against perils, there lurks some touch of peril.
7. Let a danger seem slight, and it is slight no longer.	7. Better have to do with a few perils of long-standing, than with the vain threats of every passing peril.

Essay XXIV.

For.	*Against.*
1. All medicines are innovations.	1. New-born creatures are always unshapely.
2. He that shuns new remedies waits for new evils.	2. I would have no founder but time.
3. Time is the greatest innovator; why, then, should we not imitate him?	3. There's nothing new that does not do some wrong: for the new patch rends the old coat.
4. As for precedents, ancient ones are inappropriate; modern are corrupt and selfish.	4. Things that have won their way through custom, even if not good yet fit well together.
5. Leave it to fools and quibblers to regulate their actions by precedent.	5. What innovator succeeds in imitating Time, who so insinuates his innovations that they are imperceptible.
6. As those who bring honours into a family are commonly more deserving than their descendants; so are precedents mostly better than imitations.	6. Whatever comes unexpectedly causes less pleasure where it helps, and more displeasure where it harms.
7. A forward retention of custom is as turbulent a thing as an innovation.	
8. Since of themselves things change for the worse; if by wise counsel we do not change them for the better, what end will there be of evil?	
9. The slaves of custom are the laughing-stocks of time.	

II. QUESTIONS ALREADY SET ON 'HAMLET.'

1. Paraphrase—

'In the corrupted currents of this world'
To 'Yet what can it, when one cannot repent?'

2. Analyse the above passage, and parse *shove, by, prize, out, There, compelled, then?, Try, can.*

3. Name and distinguish the principal characters in the play.

4. Explain in simple language the way in which Hamlet brings home to his mother and to the king the murder which had been committed.

5. Give instances of certain sayings in the play which have become almost household words.

6. The plays of Shakespeare have been divided into two periods. Contrast these periods, and show, by quotations, to which of the two periods you consider 'Hamlet' to belong.

7. Illustrate from 'Hamlet' some of the characteristic beauties of the style of Shakespeare.

8. Give a brief sketch of the plot of 'Hamlet.' What contemporary events are supposed to have influenced the play?

9. Name some of the figures of speech most commonly used in poetry, and give examples of each from 'Hamlet.'

10. Whence did Shakespeare obtain the materials for 'Hamlet'?

11. Can you recall any words, phrases, or grammatical forms which are employed by Shakespeare in this play, and which are not obsolete?

12. Paraphrase—

'This is the very ecstasy of love,'
To 'That does afflict our natures.'

13. Paraphrase—

'The single and peculiar life is bound,'
To 'The lives of many.'

14. Explain the following :—

(*a*) 'Then no planets strike.'
(*b*) 'Like Niobe.'
(*c*) 'The Nemean lion's nerve.'
(*d*) 'The paragon of animals.'
(*e*) 'The altitude of a chopine.'
(*f*) 'Of the chameleon's dish.'
(*g*) 'The mutines in the bilboes.'
(*h*) 'This quarry cries on havoc.'
(*i*) 'I bought an unction of a mountebank.'

15. Explain :—

(*a*) 'Unhouseled, disappointed, unaneled.'
(*b*) 'The other motive
Why to a public count I might not go,
Is the great love the general gender bear him.'

16. Sketch briefly the character of Polonius.

17. Paraphrase—

'O what a noble mind is here o'erthrown,'
To 'To have seen what I have seen! see what I see!'

18. Paraphrase—

'The single and peculiar life is bound,'
To 'Did the king sigh, but with a general groan.'

19. Work in plain language a brief essay on the character of Hamlet.

20. Say in what sense Shakespeare used the following words, and give in each case the derivation :—*Censure, clepe, cerements, unanealed, lazar-like, gyves, fantasy, conceit, unction, occulted.*

21. Analyse :—

'What would he do
Had he the motive and the cue for passion
That I have.'

22. Comment on the grammar of the following passages, and parse the words in italics :—(*a*) '*Pray* you, no more.' (*b*) 'Tell me *he* that knows.' (*c*) '*Shall* we to the court?' (*d*) 'Rich gifts wax poor.' (*e*) 'Try what repentance *can*.'

23. Take one of these characters :—*Polonius, Laertes, Osric.* Say what part he plays in the drama, and illustrate your answer by quotations.

24. What inference may be drawn from the play of 'Hamlet' respecting the state of the drama and of theatrical representation in Shakespeare's time?

25. Explain why it is that so high a rank is usually assigned to 'Hamlet' as a work of dramatic art. What are the special literary gifts and powers which are exhibited in this play? What other dramas of Shakespeare's are usually classed with 'Hamlet' as belonging to the same period?

26. Quote from this play any passages which you consider specially memorable on account of either (*a*) the beauty of the expression, or (*b*) the worth of the truth expressed.

III. MENTAL ARITHMETIC.

(*Twenty minutes allowed.*)

1. Add together squares of 3, 4, 5, 6.

2. Interest on £400 at 5 per cent. for 7 months.

3. 3½d. per week for a year.

4. How many coins worth 2½d. each could be obtained for £4 10s.?

5. How many yards of carpet, half-a-yard wide, will be needed to cover a floor 24 feet × 18 feet?

6. What must I pay for 3 doz. books at 9d. each, deducting 25 per cent.

7. As 80 : ( ) :: 72 : 54.

8. $(27)^2 + (72)^2$.

9. 7832 × 25 and 688 × 99.

10. $\frac{2}{3}$ of £1 + £1·35 + $\frac{7}{12}$ of 2½s. + ·3s.

11. Express as decimals of £1 the following sums :—18s., £2½, 15½s.

12. $\frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \frac{1}{8}$.

13. Average height of A, B, C, D, A being 5 ft., B 5½ ft., C 5¾ ft., D 61 inches.

14. Divide £180 between A and B in the ratio of 33 to 12.

ANSWERS.

1. 86.
2. £11 13s. 4d.
3. 15s. 2d.
4. 480.
5. 96.
6. £1 0s. 3d.
7. 60.
8. 5,913.
9. 195,800, 68,112.
10. £1 17s. 9½d.
11. ·9, 2·25, ·775.
12. $\frac{1}{16}$.
13. 5⅞ ft.
14. £132, £48.

IV. THE CHANGE IN THE TRAINING COLLEGE YEAR.

The change in the academical year of the residential training colleges that will take place in 1895 will require some alteration in the amounts and times of the payments made to the colleges. These changes will be embodied in the Code for 1895; but it has been thought by the Education Department that it may be convenient that the authorities of the colleges concerned should know before next spring the arrangements it is proposed to make. A circular has therefore been issued, from which we gather that the temporary changes, in consequence of the year of training in 1895 being shortened to six months, will be as follows. They are given in the order of the Articles of the Code for 1895 that deal with them :—

'ARTICLE 120, SMALL PRINT.—*The two years' stamp will be allowed for a year and a half's training and the three years' stamp for two and a half year's training, in the case of all students whose training is shortened by the change in the date of the examination.*

'ARTICLE 122.—The grants placed to the credit of the college on account of each student whose training is so shortened will be reduced, the grants on account of two years' training by one-fourth, those on account of the third year's training by one-half.

'ARTICLE 123.—For students whose one year of training is shortened to six months, the grant credited to the college will be one-fourth of the sum specified in Article 122.

'ARTICLE 125.—A half year's grant will be paid for the six months ending 30th of June, 1895, and the limit under (*a*) will be 75 per cent. of the expenditure for those six months, and that under (*b*) one-half of each of the sums stated.'

The permanent changes that will be made are the following :—

'1. After the 30th of June, 1895, the beginning of the academical year will be the 1st of July, and the accounts of the colleges must be made up and audited for years ending the 30th of June.

'2. The instalments under Article 126 will be paid, as they are in day training colleges, on 1st of October, on 1st February, and 1st of May.'—*Schoolmaster.*

V. NOTES ON GRAMMAR.

(*a*) It is a common error when a Verb governs an Infinitive Gerund, as '*He attempted to fly*,' to place both the Verbs in the Predicate, whereas *to fly* should be in the Object. The rule is, that no Verb in the Infinitive should go in the Predicate, unless the preceding Verb is distinctly an Auxiliary.

(*b*) Infinitive Verbs are not pure Verbs. They are either Adjectives, Adverbs, or Nouns, according to the office they fulfil in the sentence, *e.g.*:—

'A proceeding *to be scorned*.' (Adj.)
'I come *to bury* Caesar.' (Adv.)
'He practised every pass and ward
To thrust, to strike, to feint, to guard.' (Nouns.)

Unless this be well understood, correct Analysis is impossible.

(*c*) Infinitive Verbs are seldom parsed fully. Below are specimens of the proper method :—

to be scorned	Verb, Regular, (Weak) Trans., Pass., Infin., used as an Adj., qualifying '*proceeding*.'
to bury	Verb, Regular, (Weak) Trans., Act., Infin., used as an Adv. of Purpose, modifying '*come*.'
to feint	Verb, Regular, (Weak) Intrans., Infin., used as a Gerund, governed by '*practised*' (or in apposition to '*pass*' and '*ward*.')

(*d*) Intransitive Verbs are often parsed as having *Voice*. This is incorrect.

(*e*) It is well to underline and place in inverted commas the words of the passage that are quoted in the body of the Parsing. (See *c*.)

(*f*) Astonishing to relate, the Possessive signs of Nouns are often omitted or misplaced, especially in the Plural.

(*g*) The word '*as*' following its antecedents '*such*,' '*same*,' is a Relative Pronoun. It is very frequently thus used by Shakespeare.

(*h*) The Adjective force of '*his*' is well shown by its being *modified* in the following sentence, '*It appalled* EVEN *his proud spirit*.' Here the Adverb '*even*' modifies '*his*.' If '*his*' were merely a Pronoun it would be incapable of modification.

(*i*) The double offices of Relative Pronouns, Connective Adverbs, Participles, and Gerunds are often forgotten.

A Relative Pronoun both connects and is substantival.
A Connective Adverb both connects and is adverbial.
A Participle (especially in the Active Voice) is both verbal and adjectival.
A Gerund is both verbal and substantival.

(*j*) Note the following difficulties in Analysis :—

The Verb '*to be*' is not copulative when it means '*to exist*,' and in the latter instance it can form the Predicate by itself.

Sentences connected by '*where*' are often Adjective ones and not Adverbial, for '*where*' = '*in which*.'

Occasionally, especially in Middle English, '*which*' or '*who*' does not, strictly speaking, introduce an Adjective Sentence, *e.g.*:—

He overtook James, who had previously departed.'

The Sentence '*who had previously departed*,' although generally spoken of as Adjectival, is more accurately a Principal Sentence, co-ordinate to '*He overtook James*' ; for it does not really qualify, but rather expresses an additional assertion.

Mechanical directions for Analysing often mislead. For instance, the Conjunction '*that*' is often said to introduce invariably a Noun sentence. But the word '*that*' often means '*so that*,' and then the following sentence is Adverbial, *e.g.*:—

'*I swore to bury his Mighty Book*,
THAT *therein mortal might never look*.'

The second sentence is here distinctly an Adverb.

The Conjunction '*that*' may introduce—
(1) *A Noun Sentence*, as : 'I said that he might go.'
(2) *An Adjective Sentence*, as : 'It is a proof that you are wrong.'
(3) *An Adverb Sentence* (α) *of Degree*, as : 'I am so weary that I cannot speak.' (β) 'I came that he might go.'

VI. NOTES ON ALGEBRA.

(*a*) Second Year Ladies are strongly urged to take up this subject. One section of their Arithmetic paper will contain alternative questions on Elementary Algebra.

This knowledge will not only be also useful in furnishing the key to many difficult arithmetical problems, but will be serviceable for and preliminary to University examinations and others, such as those of the Fröbel Society.

(*b*) Mistakes are sometimes made in Equations through dividing by a quantity that turns out to be equal to zero or nought.

The following is an amusing instance :—

Let	$x = y$.
Then	$x^2 = xy$,
,,	$x^2 - y^2 = xy - y^2$,
,,	$\frac{x^2 - y^2}{x - y} = \frac{xy - y^2}{x - y}$,
,,	$x + y = y$,
,,	$2y = y$,
,,	$2 = 1$,

which is absurd.

(*c*) Determine c and d so that in the product of $x^2 + x + 1$, and $x^3 + cx^2 + dx + e$, the coefficients of x^4 and x^3 may vanish.

$$\begin{array}{r} x^3 + cx^2 + dx + e \\ x^2 + x + 1 \\ \hline x^3 + cx^2 + dx + e \\ x^4 + cx^3 + dx^2 + ex \\ x^5 + cx^4 + dx^3 + ex^2 \\ \hline x^5 + (c+1)x^4 + (c+d+1)x^3 + (c+d+e)x^2 + (d+e)x + e \end{array}$$

Now by hypothesis $(c + 1) = 0$, $\therefore c = -1$

and $(c + d + 1) = 0$, $\therefore d = 0$.

The result may easily be proved by substituting in the multiplier and multiplicand the obtained values of c and d.

(*d*) It is a mistake to commence the Binomial Theorem until Permutations and Combinations are thoroughly well understood.

A question almost invariably asked is '*Prove the rule for finding the number of combinations of* N *different things taken* R *at a time*.'

(*e*) The sum of four numbers in geometrical progression is equal to the common ratio + 1 ; and the first term = $\frac{1}{17}$. Required the numbers.

Let x = the common ratio ;

$\therefore$ the numbers are $\frac{1}{17}, \frac{x}{17}, \frac{x^2}{17}, \frac{x^3}{17}$;

and $1 + x = \frac{1 + x + x^2 + x^3}{17} = \frac{(1 + x^2)(1 + x)}{17}$;

$\therefore 1 = \frac{1 + x^2}{17}$; $\therefore 17 = 1 + x^2$; $\therefore 16 = x^2$; $\therefore x = \pm 4$;

and the numbers are $\frac{1}{17}, \frac{4}{17}, \frac{16}{17}, \frac{64}{17}$. Ans.

(*f*) A pyramidical pile of cannon balls, the base of which was an equilateral triangle, was all used in an engagement, except the three lowest layers, and four balls of the next layer. These were afterwards formed into a pile with a rectangular base, having as many balls in one side of the lowest layer as there were in a side of the lowest layer of the pyramid, and four in the adjacent side. What was the number of balls ; and what the number of layers in each pile when complete?

Let x = the number of balls in a side of the lowest layer.

Then $x \times \frac{x+1}{2}$ = the number of balls in that layer ;

and $(x - 1) \times \frac{x}{2}$ = ,, ,, second ,,

and $(x - 2) \times \frac{x-1}{2}$ = ,, ,, third ,,

$\therefore \frac{3x^2 - 3x + 2}{2} + 4$ = the whole remaining number.

Now, because there were only four balls in one side of the second pile, there can only be four layers which will contain $4x$, $3(x - 1)$, $2(x - 2)$, and $x - 2$ respectively.

$$\therefore \frac{3x^2 - 3x + 2}{2} + 4 = 10x - 10 ;$$

$$\therefore 3x^2 - 3x + 10 = 20x - 20 ;$$

$$x^2 - \tfrac{23}{3}x + 10 = 0,$$

$$(x - 6)(x - \tfrac{5}{3}) = 0,$$

$$\therefore x = 6. \text{ Ans.}$$

For $x = \frac{5}{3}$ is inadmissible.

(*g*)
$$(a-3)(a+4)(a-5)(a+6)$$
$$= a^4$$
$$+ (-3+4-5+6)\,a^3$$
$$+ (-12+15-18-20+24-30)\,a^2$$
$$+ (60-72+90-120)\,a$$
$$+ 360$$
$$= \underline{a^4+2a^3-41a^2-42a+360}. \quad \text{Ans.}$$

(*h*) Required the coefficient of a^3 in the product $(a-1)(a+2)(a-3)(a+4)(a-5)$. Here the term involving a^3 will be found by multiplying together the a of any three factors, and the two numerical quantities out of the two remaining factors; that is to say, the coefficient equals the sum of the products of

$-1, +2, -3, +4, -5$ taken two at a time,

or, $-2+3-4+5-6+8-10-12+15-20$

$= \underline{23}$. Ans.

(*i*) To expand $(x-y)^5$.

First step, $x^5 \quad x^4y \quad x^3y^2 \quad x^2y^3 \quad xy^4 \quad y^5$.

Second step, $x^5 - x^4y + x^3y^2 - x^2y^3 + xy^4 - y^5$.

Third step, $x^5 - 5x^4y + (\frac{4}{1}\times 5)\,x^3y^2 - (\frac{3}{2}\times\frac{4}{2}\times 5)\,x^2y^3 + (\frac{2}{3}\times\frac{3}{2}\times\frac{4}{1}\times 5)\,xy^4 - (\frac{1}{4}\times\frac{2}{3}\times\frac{3}{2}\times\frac{4}{1}\times 5)\,y^5$.

Fourth step, $\underline{x^5 - 5x^4y + 10x^3y^2 - 10x^2y^3 + 5x^4y - y^5}$. Ans.

(*j*) To expand $(x-2z)^5$.

Take the result of (*i*) and merely substitute $2z$ for y, thus—

$x^5 - 5x^4\,(2z) + 10x^3\,(2z)^2$, etc.

Similarly also in expanding $(3a-2z)^5$.

(*k*) To find the sixth term of $(a+2x^2)^{17}$.

$$\frac{17\times 16\times 15\times 14\times 13}{1\times 2\times 3\times 4\times 5}\,a^{12}\,(2x^2)^5 = 6188a^{12}\times 32x^{10}$$
$$= \underline{198016a^{12}x^{10}}. \quad \text{Ans.}$$

VII. Government Questions already given upon Tudor Period.

1. Write short accounts of Shakespeare, Wolsey, Thomas Cromwell, Drake, Katherine of Aragon, Cranmer, Queen Elizabeth, Raleigh, and Knox. (1870), (1872), (1873), (1875), (1876), (1879), (1880), (1882), (1884), (1885), (1887.)

2. What was the 'Statute of the Six Articles'? Give an account of the chief proceedings under it, and the cases of those who suffered thereby. (1870), (1871), (1872), 1874), (1886.)

3. Describe the war between England and Scotland in 1542. (1870), (1874.)

4. The changes made in the reign of Queen Mary, and the character and death of Cranmer. (1870.)

5. An account of the religious and political principles of the Puritans, and of their chief men. (1870.)

6. Describe the chief constitutional changes of the Tudor Period. (1870), (1875), (1883), (1886.)

7. What were the charges against Mary Queen of Scots? Give particulars of her trial and death. (1870), (1878.)

8. What were the claims of Henry VII. to the crown, and how were they settled by Parliament? (1870), (1871), (1872), (1873), (1874), (1881), (1882), (1887), (1888), (1890), (1891.)

9. The pretensions of Perkin Warbeck; his invasion; the support afforded him from Scotland and Burgundy. (1870), (1871), (1875), (1892.)

10. The political character of Henry VII.; the improvements in law and commerce during his reign. (1870), (1871), (1875), (1876), (1879), (1883), (1886.)

11. The war with France, 1512–14. (1870.)

12. The policy of Somerset in the reign of Edward VI.; the accusations against him; the causes of his condemnation. (1870), (1874), (1875), (1892.)

13. The state of Ireland in the reign of Queen Elizabeth. (1870), (1875), (1879), (1880), (1882), (1883), (1885), (1889.)

14. The expedition against Cadiz in 1596. (1870), (1872.)

15. The character of Sir T. More, Cardinal Pole, Sir P. Sidney, and Lord Burleigh. (1870), (1872), (1873), (1889.)

16. The conspiracies of Henry VII.'s reign. (1870), (1871), (1873), (1874), (1877), (1886.)

17. Chronological account of wars with Scotland in Henry VIII.'s reign. (1870), (1871), (1875), (1882), (1889.)

18. Give particulars of the marriage of Queen Mary I., and state its consequences in her own and the following reigns. (1870), (1873), (1885.)

19. Give the sovereigns of the Tudor family, with their dates. Under each mention events of importance. (1871.)

20. Mention the marriages and issue of Henry VIII. What political motive has been assigned for his repeated marriages? Show its importance to the nation. (1871), (1889.)

21. Describe the relations of England under Elizabeth towards Scotland, Spain, Netherlands, and France. (1871), (1882), (1883), (1890), (1892.)

22. What different views are taken of the character of Mary Queen of Scots? Illustrate your answer by the events of her life. (1871), (1872), (1873), (1874), (1875), (1879), (1880), (1881), (1882), (1883), (1885), (1887), (1889.)

23. How was England interested in the League of Cambray and the Holy League? What effect had the latter upon Scottish History? (1871), (1882.)

24. The 'Pilgrimages of Grace.' (1871), (1873), (1878), (1883), (1887.)

25. At the death of Edward VI., what ladies were interested in the succession? Investigate their respective claims and describe any attempts made to assert them. (1871), (1872), (1881), (1887.)

26. The progress of commerce under Mary and Elizabeth. (1871.)

27. The 'Bill of Attainder'; by whom devised, how long employed; with mention of some of its victims? (1871), (1888.)

28. What was 'Maintenance' or 'Livery'? When was it abolished? (1871.)

29. What part did Henry VII. take in the affairs of Europe? (1871), (1872.)

30. Distinguish the character and policy of the Tudors from those of the Stuarts. (1871.)

31. Give the chief events of Henry VIII.'s reign. (1872.)

32. What was the Spanish Armada? Compare it with the English Navy (1588), and describe its fate. (1872), (1874), (1879), (1883.)

33. The indictment laid against Cardinal Wolsey, and the bearings of the same upon the clergy generally. (1872.)

34. The Court of Star Chamber and of High Commission. (1872), (1873), (1874), (1876), (1888), (1889), (1890.)

35. Who were Empson and Dudley, and what means did they employ to augment the royal revenue and enrich themselves? (1873.)

36. What was a 'Benevolence' and a 'Monopoly'? When was this mode of raising money first employed, and when finally put an end to? (1873), (1877), (1883), (1886.)

37. The transactions which led to the attack upon Zutphen, and the death of Sir P. Sidney. (1873), (1877.)

38. Queen Elizabeth's policy in general, and especially in her treatment of Parliament. (1873), (1892.)

39. The progress of Education in the Tudor period, with notices of Englishmen and Scots who were eminent for their learning. (1873), (1883).

40. Name the causes and the chief promoters of the Reformation in England. State what Acts of Parliament separated the English from the Romish Church. (1874.)

41. Who were the following:—Anne Askew, Cardinal Pole, Miles Coverdale, Campeggio, David Rizzio, Alva? (1874.)

42. Describe the circumstances which led to the disgrace and death of the Earl of Essex. (1874.)

43. Name the most famous soldiers, statesmen, and writers in Elizabeth's reign. Mention any remarkable inventions or discoveries that took place during her period. (1874), (1875), (1879), (1882), (1883), (1887), (1888), (1892.)

44. Name the children of Henry VII., and give an account of the marriages of his children respectively. (1874), (1889), (1891.)

45. Relate as fully as you can the events connected with the capture of Calais. (1875.)

46. What famous foreign monarchs were contemporary with Henry VIII.? In what wars was he involved at various times? (1875.)

47. The most successful monarchs have been those who have sought the love of their people. Illustrate the truth of this statement by the reign of Queen Elizabeth. (1876.)

48. Give an account of the insurrections which occurred in the reign of Edward VI., and of the causes which led to them. (1876.)

49. Write a short account of Caxton and Columbus. (1877), (1889.)

50. To what causes may you attribute the settlement of French and Flemish workmen in England towards the latter part of the 16th century? Describe the particular work in which these persons were engaged, and the result of their migration to this country. (1877.)

51. Describe the policy of Henry VII. and Henry VIII. towards Ireland. (1878.)

52. Describe the difficulties of Queen Elizabeth at her accession. (1878), (1883.)

53. What differences were displayed by Henry VIII. and Elizabeth in their respective treatments of their favourites? (1878.)

54. Mention the most celebrated of the Elizabethan poets, and give some account of their works. (1880.)

55. Make a table showing the grandchildren and great-grandchildren of Henry VII. (1881), (1884.)

56. Give a sketch of the social condition of England during the Tudor period. (1881.)

57. Give a brief account of the reign of Edward VI. (1882.)

58. Mention some of the most remarkable contrasts brought out by a comparison of the condition and habits of the English people in the 16th century, and at the present time. (1882), (1883), (1888.)

59. Recount the chief incidents in the reign of Elizabeth. (1886.)

60. Name six of the most remarkable books which were written during the Tudor Period. Say who wrote them and what they were about. (1886.)

61. Compare the Parliaments of Henry VIII. and Charles II. (1888.)

62. In what way was the power of the aristocracy affected by the Reformation? (1888.)

63. Describe in order the chief measures of the Parliament which met in 1529 and lasted until 1536. In what way was the destruction of the monasteries disadvantageous, and how were the evils that it caused met under Edward VI. and Elizabeth? (1890), (1891.)

64. The reign of Edward VI. was a time of nominal Protestantism discredited by bad government; that of Mary, a time of nominal Catholicism discredited by cruelty and national failure. Illustrate this. (1890.)

65. The reign of Elizabeth was a duel with Rome. What were the counter-thrusts to (1) The Pope's declaration of her illegitimacy; (2) The forbidding of Romanists to obey the Act of Uniformity; (3) The excommunication of Elizabeth. (4) The Jesuit attack; (5) The assassination plots? (1890), (1892.)

66. How did the legislation of Henry VII. strengthen the central power? (1891.)

67. What were the main principles of Wolsey's (1) foreign, (2) home policy? On what charge was he finally ruined? (1891.)

VIII. Parsing, Analysis, Paraphrasing, for Routines.

A. First Year.

(*a*) First Friday (*Men*). 'Coming of Arthur,' Lines 208 to 214 for Analysis. Parse *night, That, all, born, all, as, soon, as, Delivered, to be holden, Until.*

(*b*) First Friday (*Women*). 'The Princess,' Canto II., Lines 153 to 164 for Analysis. Parse *Dilating, everywhere, two, dropt, secrets, critic, more, should, bear, whose.*

(*c*) Third Monday (*Men*). 'Coming of Arthur,' Lines 338 to 347 for Analysis. Parse *King, true, first, when, maid, Beaten, Whereof, was, myself, therein, whether.*

(*d*) Third Monday. (*Women*). 'The Princess,' Canto III., Lines 109 to 119 for Analysis. Parse *crabbed, Better, heave, down, Than, hammer, bidden, entered, phrase.*

(*e*) Fourth Monday (*Men*). 'Passing of Arthur,' Lines 446 to 456. Parse *Whereat, clamb, Thence, moving, healing, come, no, me, be, Queens, three friends, should.*

(*f*) Fourth Monday (*Women*). 'The Princess,' Canto IV., Lines 358 to 367. Parse *chalked, whereby, Delivering, which, silent, Regarding, while, till, As.*

B. Second Year.

(*a*) First Friday (*Men*). As in First Year.

(*b*) First Friday (*Women*). 'Coriolanus,' Act I., Scene iii., Lines 59 to 69 for Analysis. Parse *word, son, boy, half, hour, together, has, run, when, let, after, catched.*

(*c*) Second Friday (*Men*). 'Hamlet,' Act II., Scene ii., lines 211 to 218 for Paraphrasing.

(*d*) Second Friday (*Women*). 'Coriolanus,' Act I., Scene x. Lines 1 to 16 for Paraphrasing.

(*e*) Third Friday (*Men*). 'Hamlet,' Act IV., Scene vi., Lines 12 to 30 for Paraphrasing.

(*f*) Third Friday (*Women*). 'Coriolanus,' Act IV., Scene vi., Lines 121 to 139 for Paraphrasing.

IX.—Selected Government Questions.

FIRST YEAR.

Second Week.

1. Write in Large hand the words '*Lymphathic Tendency.*'

Write in Small hand the lines—

'*Perchance that very hand, now pinioned flat,*
Has hob-a-nobbed with Pharaoh glass to glass.'

2. Write from Dictation :—

'Another striking phenomenon respecting the sun and moon in the horizon must not be entirely passed over, although rather belonging to the science of Optics, viz., their great apparent magnitudes. The cause of this, undoubtedly, is the wrong judgment we form of their distances then, compared with their distances when their altitudes are greater.

3. It is said to be a good principle in teaching that '*we should proceed from the known to the unknown.*' Discuss this dictum; and show how it ought to regulate, for example, the mode of commencing a lesson on some unfamiliar object.

4. Write out brief notes of a lesson on one of these subjects :—

(*a*) The cases of Pronouns.
(*b*) The House of Commons.
(*c*) Snow and Hail (*for Infants*).

5. Give a few rules for securing '*Sweetness of Tone*' in Singing.

6. State the meaning of Sforzato, Calando, Meno, Con brio, Tenuto, and Piu.

7. Analyse and parse from Routine.

8. Write a brief Essay upon '*Poets learn in sorrow what they teach in song,*' exemplifying this dictum by reference to the life of Tennyson *or* Byron.

9. Map from Routine.

10. Enumerate the chief islands of N. America *or* Asia, and describe their salient features.

11. Give the descent of George I. from Henry II.

12. (*Men only.*) Write short lives of Monk and Monmouth.

(*Women only.*) Write short lives of Anselm and Laud.

13. A tradesman sells an article for £12, thereby losing 4 per cent., and recovers his loss by selling another article for £8. Find his gain per cent. on the second article. Ans. $6\frac{2}{3}$ per cent.

14. (*Men only.*) (*a*) Find a multiplier which will make a given binomial surd as $\sqrt{a} + \sqrt{b}$ rational. Ans. $\sqrt{a} - \sqrt{b}$.

(*b*) Reduce $\frac{3}{\sqrt{5} - \sqrt{2}}$ to a fraction with a rational denominator.

Ans. $\frac{\sqrt{5} + \sqrt{2}}{1}$.

(*Women only.*) A labouring man earns 15s. per week. Describe the kind of supper which, without extravagance, his wife might cook and share with him on his return from work. What points should she attend to in order to make the meal a comfortable one?

15. (*Men only.*) Solve the equations :—

(*a*) $\frac{8x-15}{27} - \frac{5x-\frac{2x-1}{7}}{18} - \frac{x-30}{12} = 3\frac{1}{8}$. Ans. $x = 39$.

(*b*) $\sqrt{x+a} - \sqrt{x-a} = \sqrt{x}$. Ans. $x = \frac{2a}{\sqrt{3}}$.

(*c*) $\left.\begin{aligned} x^3+y^3 &= 1843 \\ x^2-xy+y^2 &= 97 \end{aligned}\right\}$ Ans. $x = 11, y = 8$.

(*Women only.*) What are the chief elements in the composition of air, and in what proportion do we find them? Describe their special properties.

16. (*Men only.*) A rectangular bowling green having been measured, it was observed that if it were 5 feet broader and 4 feet longer, it would contain 116 sq. feet more; but, if it were 4 feet broader and 5 feet longer, it would contain 113 sq. feet more. Find length and breadth. Ans. 12 ft., 9 ft.

17. (*Men only.*) Upon the same base how many scalene triangles equal in every respect can be constructed? Draw the figures and show that three parallelograms have been thereby constructed.

(*Women only.*) Write notes of a lesson on 'Milk as a perfect food.'

18. (*Men only.*) Write out Euclid III. 36.

In any right-angled triangle the hypotenuse is so divided that the rectangle contained by the whole and one of the parts is equal to the square on the side adjacent to that part. Prove that the circle described on the other side as diameter will intersect the hypotenuse at the given division.

Fourth Week.

1. Write in Large hand the words '*Nymphs of Tuscany.*'

Write in Small hand the lines—

'*This world is all a fleeting show*
For man's illusion given.'

2. Write from Dictation :—

'The Tudor period is almost synchronous with the sixteenth century, an age remarkable for its material prosperity, its intellectual and religious activity, and its political retrogression. The mighty impulse given to commerce by maritime discoveries, coupled with the certainty imparted to the science of navigation by the use of the compass, caused an enormous increase of the wealth of the middle classes.'

3. What is meant by the faculty of observation, and why is it desirable to cultivate it? Give some examples of exercises calculated to strengthen this faculty (1) in a rural school, *or* (2) in a school situated in a large town.

4. Describe the kind of manual employments best suited to give, to very little children, ideas of form and of construction, and to give early training in invention and design.

5. What are the chief faults in ordinary School Singing, and how may they be remedied?

6. Give the Italian equivalents for '*as loud as possible*,' '*soft and sweet*,' '*slow*,' '*heavy and slow*,' '*with fire*,' and '*in a sprightly manner*.'

7. Analyse and parse from Routine.

8. Write a short summary of the 'Passing of Arthur,' *or*
What are the principal 'Figures of Speech'? Give illustrations from 'The Princess.'

9. 'The capacity of the air for vapour is regulated by its temperature.' Explain this. How can the height of the atmosphere be approximately determined? What are the main causes of variations in atmospheric pressure at a given place?

10. (*Women only.*) Where and what are Balkash, Karkorum, Petropaulovski, Macao, Yarkand, Kuldja, and Asoyama?

(*Men only.*) Where and what are Hooker, Yellowstone, Dismal Swamp, White House, Milwaukee, Sioux?

11. Merely mention the occasions when England and Spain have been in collision and when in alliance.

12. What historical incidents are connected with Bouvines, Estaples, St. Bartholomew's Day, Hampton Court, Breda, and Algiers?

13. Find the present worth of £1,000 due 100 days hence at 10 per cent. per annum. Ans. £973 6s. 8d.

14. (*Men only.*) Extract the square root of :—

(*a*) $x^6+1-4x^5+4x+6x^3+8x^2$. Ans. x^3-2x^2-2x-1.

(*b*) $8-4\sqrt{3}$. Ans. $\sqrt{2}(\sqrt{3}-1)$.

(*Women only.*) Give a description of the lungs and their functions, describing the way in which the health is affected by breathing impure or exhausted air.

15. (*Men only.*) A man has a certain number of crowns and florins. If the crowns were florins and the florins crowns, his money would be increased by 12s. The square of the number of crowns and the square of the number of florins together equal 296. How many crowns and how many florins had he? Ans. 10 and 14.

(*Women only.*) What is meant by indigestion, how is it caused, and how and why should it be prevented?

16. (*Men only.*) Find the length of the edge of a cube which contains 450 feet 1·088 c. in. Ans. 7 ft. ·8 in.

17. (*Men only.*) Write out Euclid I. 16, and show therefrom that no angle of a triangle can be equal to two right angles.

(*Women only.*) What principles would guide you in the selection of boots and gloves?

18. (*Men only.*) Write out Euclid III. 37.

Describe a circle which shall pass through two given points and touch a given straight line.

SECOND YEAR.

Second Week.

1. As in First Year.

2. As in First Year.

3. Discuss the relative advantages of (*a*) hot-air pipes, (*b*) hot-water pipes, and (*c*) open stoves as means of warming a school. Say at what temperature it should be kept.

4. Write notes of a lesson on '*Union is Strength*,' OR (for infants) on '*Simple geometrical forms.*'

5. As in First Year.

6. As in First Year.

7. Give instances from 'Coriolanus' *or* 'Hamlet' of Double Comparatives, Double Superlatives, and Double Negatives.

8. (*Men only.*) As in First Year, Fourth Week.

(*Women only.*) Paraphrase from Routine.

9. As in First Year.

Describe the flora and fauna of British North America *or* New Zealand.

10. (*Men only.*) As in First Year.

(*Women only.*) Draw a map of New South Wales.

11. (*Men only.*) As in First Year.

(*Women only.*) Describe a voyage round Australia.

12. (*Men only.*) As in First Year.

(*Women only.*) What do you know of Drake, Hawkins, Frobisher, Ben Jonson?

13. (*Men only.*) As in First Year.

(*Women only.*) What events are connected with Guinegate, Langside, Zutphen, Halydon Rigg, Fotheringay, and Boulogne?

14. (*Men only.*) If in an infinite Geometric series any term be equal to the sum of all that succeed it, show that the common ratio will be $\frac{1}{2}$.

(*Women only.*) Write short lives of Sidney and Pole.

15. (*Men only.*) Employ the Binomial Theorem to find the Compound Interest on £100 for 5 years at 10 per cent.
Ans. £61 1s. 0·24d.

(*Women only.*) Cut out in paper the right half of a shirt for a boy ten years old.

16. (*Men only.*) A pyramid is cut into two pieces by a plane parallel to the base, midway between the vertex and the base. Show that one piece is seven times the other.

(*Women only.*) As in First Year, Question 17.

17. A train 88 yards long overtook a person walking along the line at the rate of 4 miles an hour, and passed him completely in 10 seconds. It afterwards overtook another person and passed him in 9 seconds. At what rate per hour was this second person walking? Ans. 2 miles.

18. (*Men only.*) Prove that the equilateral triangle described on the hypotenuse of a right angle triangle is equal to the sum of the equilateral triangles described on the other two sides.

(*Women only.*) Mention the most suitable forms of nutriment for an invalid forbidden to take solid food.

19. (*Men only.*) If $x = \frac{1}{3}$, find the greatest term in the expansion of $(1+4x)^{15}$. Ans. $\frac{57344}{243}$.

CERTIFICATE ROUTINE FOR NOVEMBER 1894 (MEN AND WOMEN, FIRST YEAR).

DAYS	FIRST WEEK.			SECOND WEEK.			THIRD WEEK.			FOURTH WEEK.		
	I.	II.	III.	I.	II.	III.	I.	II.	III.	I.	II.	III.
MONDAY	Methods of Questioning	Read Bacon's Essays, 30, 31, 32 *or* 'Life of Byron,' pp. 63 to 80	Euclid, Book II. *or* Repairing Underclothing	The Nature and Aims of the Subjects taught in Elementary Schools	Read Bacon's Essays, 36 and 38 *or* 'Life of Byron,' (Notes)	Euclid, Book III., Props. 1 to 19 *or* Diagram of an Infant's Shirt	Training of Eye and Ear	Analyse, etc. (*See Article*)	Euclid, Book III., Props. 19 to 37 *or* Any Needlework	The Reasoning Powers	Analyse, etc. (*See Article*)	Euclid, Book I., Props. 26 to 48 *or* Questions on Needlework
TUESDAY	Chief Dates from 1216 to 1300	Clock Sums	Geography of Eastern British N. America *or* Turkey in Asia	History from 1625 to 1650	Mensuration of the Triangle *or* Vulgar Fractions	Climatic effects	Chief Dates from 1300 to 1400	Discount *or* Decimals	Geography of Eastern United States *or* Persia, Beluchistan, Afghanistan	Chief Dates from 1600 to 1700	Compound Proportion	Geography of Mexico and Alaska *or* Hindostan
WEDNESDAY	Ratio and Proportion of Algebra *or* Cleansing of Clothing	Numerical Geographical Statistics	How to teach Mathematical Geography	Factors of Algebra *or* Warming and Lighting of the Home	Cube Root *or* Theory of Repeaters	Music — Transcription	Any Geography *or* Composition and Uses of Air	Square Root *or* Simple Interest	Euclid, Book II. *or* Cutting-out of a Woman's Chemise	Quadratics *or* Respiration	Mensuration of Parallelograms *or* Compound Interest	Distribution of Plants and Animals
THURSDAY	History from 1600 to 1625	Variation *or* Construction and Furnishing of the Home	Maps of British Columbia and N.W. Territories *or* North Hindostan	History from 1650 to 1675	Arithmetical Progression *or* Cleanliness of the Home	Geography of Western British N. America *or* Corea	History from 1675 to 1700	Harmonical Progression *or* Ventilation	Maps of Vancouver Island and Great Lakes *or* the Corea	History from 1700 to 1730	Problems involving Quadratics *or* Organs of Respiration	Geography of Western United States *or* China
FRIDAY	Musical Terms and Signs	Deductions on Euclid, Book I. *or* Diagram of a Pair of Drawers	Analysis and Parsing (*See Article*)	Most important Laws of the Period *or* Dynastic Tables	Deductions on Euclid, Book II. *or* Cutting-out of a Woman's Chemise	Briefly write out substance of Bacon's Essays, 39 and 50 *or* 'Princess,' pp. 121 to 154	Music — Intervals	Deductions on Euclid, Book III. *or* Any Needlework	Read 'Passing of Arthur' *or* 'Princess,' pp. 155 to 188	Compound Interest	Music — Simple time *or* the required Measures	Read Notes of 'Passing of Arthur' *or* 'Princess,' pp. 189 to 221
SATURDAY	How to teach Word-building	'Mixtures' in Arithmetic	Examination *or* Revision	How to train the taste or æsthetic sense	Music — Transposition	Examination	Notes of a first Lesson on Practical Plane Geometry	Chief Dates from 1500 to 1600	Examination *or* Revision	Syntax of Prepositions, Conjunctions, and Interjections	Chief Dates from 1700 to 1815	Examination

CERTIFICATE ROUTINE FOR NOVEMBER 1894 (MEN AND WOMEN, SECOND YEAR).

CERTIFICATE ROUTINE FOR NOVEMBER 1894 (MEN AND WOMEN, SECOND YEAR).

DAYS	FIRST WEEK.			SECOND WEEK.			THIRD WEEK.			FOURTH WEEK.		
	I.	II.	III.	I.	II.	III.	I.	II.	III.	I.	II.	III.
MONDAY	The Processes of Reasoning (Jevons' Logic) *or* (Cartwright's 'Mental and Moral Science')	Read Act II. of 'Hamlet' *or* Notes of 'Coriolanus,' pp. 214 to 221	Euclid, Book I. *or* Repairing of Linen	School Organisation	Study 'Hamlet,' Act III. *or* 'Coriolanus,' Notes pp. 221 to end	Euclid, Book II. *or* Cutting-out of a Boy's Shirt	'Quick,' Chapter XVII.	Read Bacon's Essays, 32, 36, 38 *or* 'Spenser,' Chapter IV.	Euclid, Book III. *or* Repairing of Print	The Code Schedules	Read Bacon's Essays, 39, 50 *or* 'Spenser,' Chapter VI.	Euclid, Book IV. *or* Write down directions for making a Child's Muslin Pinafore
TUESDAY	As in First Year *or* History from 1485 to 1509	Mensuration *or* Stocks	As in First Year *or* General Physical Geography of Scotland	As in First Year *or* History from 1509 to 1547	Any Algebra *or* Discount	As in First Year *or* Political Geography of Ireland	As in First Year *or* Dates from 1547 to 1576	Mensuration *or* Stocks	As in First Year *or* Physical Geography of Australia	As in First Year *or* History from 1576 to 1603	Logarithms *or* Proofs of Discount, etc.	As in First Year *or* Political Geography of Australia
WEDNESDAY	Musical Terms	Binomial Theorem *or* Bread and Paste Making	Formation of Habits and Character	Logarithms *or* Beverages for the Sick	Compass and Registers of Voices	Paraphrasing (*See Article*)	Interest (Algebra) *or* Any Revision	Algebraic Arithmetic *or* A Schoolmistress's Expenditure	Deductions upon Euclid, Book II. *or* Investments	Musical Transcription	Binomial Theorem *or* Servants' Outfit	As in First Year *or* Dates from 1576 to 1603
THURSDAY	As in First Year *or* Dates from 1485 to 1547	Algebraic Interest *or* Problems on the work of Mixed Agents	As in First Year *or* Map of Ulster	As in First Year *or* Battles of the Tudor Period	Algebraic Insurance *or* Square Root	As in First Year *or* Geography of New Zealand	As in First Year *or* History from 1547 to 1576	Major Scales *or* Major and Minor Modes	As in First Year *or* Map of Southern half of Australia	As in First Year *or* Poets of the Tudor Period	Surds *or* Compound Proportion	As in First Year *or* Geography of Scotland or Ireland
FRIDAY	Binomial Theorem *or* Clothing Expenses	Deductions upon Euclid, Book IV. *or* Diagram of a Boy's Shirt	Analyse, etc. (*See Article*)	Logarithms *or* Tables of weekly dinners	Euclid, Book III., Props. 1 to 17 *or* Learn proportions of the three garments	Paraphrasing (*See Article*)	Permutations and Combinations *or* The Ordinary Beverages	Definitions of Euclid, Book V. *or* Making of a Child's Muslin Pinafore	Paraphrasing (*See Article*)	Interest and Annuities *or* Duties of a Sick Nurse	Deductions upon Euclid, Book VI. *or* Making of a Child's Muslin Pinafore	Describe the characters of 'Osric' and 'Yorick' *or* 'Sicinius' and 'Brutus'
SATURDAY	School Routines	Read 'Coming of Arthur' *or* 'Spenser,' Chapter III.	Examination *or* Revision	Notes of a first Lesson on Plane Geometry to Standard V. *or* On Colour, for Infants	As in First Year *or* Map of Wales	Examination	Principles of Kindergarten	Read 'Passing of Arthur' *or* 'Spenser,' Chapter V.	Examination *or* Revision	'Quick,' Chapter XVIII.	Musical Transposition	Examination

(*Women only.*) What qualities constitute the character of a good maid servant? How may such qualities be best encouraged during school life?

20. What is the easy range of (*a*) Treble, and (*b*) Alto voices?

FOURTH WEEK.

1. As in First Year.

2. As in First Year.

3. What are the chief 'Laws of Association'? How could you utilise them in a Geographical Lesson?

4. Draw up a Time-table for a week for the highest class of a school in which two Class subjects are taken, specifying at the foot your reasons for assigning to the closing hours of morning and evening school the special lessons you have selected for those hours.

5. As in First Year.

6. State the average compass of Trebles (children), Altos (children), Tenors, and Basses.

7. Paraphrase from Routine.

8. (*Men only.*) Say in what connection these passages stand, and what part they play respectively in Bacon's argument:—

(*a*) 'Truth will not rise to the price of a diamond or carbuncle.'
(*b*) 'Some books may be also read by deputy.'
(*c*) 'Fear pre-occupateth Death.'
(*d*) 'Late learners cannot so well take the ply.'

(*Women only.*) Explain:—

(*a*) 'To break the heart of generosity.'
(*b*) 'His brows bound with oak.'
(*c*) 'Who sensibly outdares his senseless sword.'
(*d*) 'Against the hospitable canon.'

9. (*Men only.*) Describe the principal American rivers flowing into the Arctic Ocean. What do you know of Alaska?

(*Women only.*) Give a short account of the progress of Australian exploration?

10. (*Men only.*) Give an account of (*a*) the Canons of the Colorado, (*b*) the Great Salt Lake District, (*c*) the Peninsula of Labrador, and (*d*) the Vegetation of Florida.

(*Women only.*) Map from Routine.

11. (*Men only.*) As in First Year.

(*Women only.*) Describe the rise of the Puritans.

12. (*Men only.*) As in First Year.

(*Women only.*) What are the dates 1495, 1513, 1536, 1558, 1588, and 1601 noted for?

13. As in First Year.

14. As in First Year.

15. (*Men only.*) Find the coefficient of x^r in the expansion of $\left(x^2 + \frac{1}{x^3}\right)^n$.

Ans. $\frac{\lfloor n}{\lfloor\frac{1}{5}(2n-r)\ \lfloor\frac{1}{5}(3n+3}$.

(*Women only.*) Cut out and tack together one arm of a boy's shirt, and show the stitches required in making up the garment.

16. (*Men only.*) A cone revolves on a circular plane of 5 feet radius, with its vertex in the centre. If in making the entire circuit of the circle it revolves 5 times, find the height of the cone.

Ans. 4·898 ft.

(*Women only.*) Point out the value of fish as an article of diet, and describe the different methods of cooking herring, mackerel, and cod.

17. (*Men only.*) Write down the 9th term of

$$\left(\frac{3x}{4} - \frac{2y}{3}\right)^{15}.$$

Ans. $\frac{2145}{64}x^7y^2$.

(*Women only.*) Where would you do your marketing? How would you choose fish, and how would you know whether meat is fresh and of good quality?

18. (*Men only.*) As in First Year.

(*Women only.*) Tell what you know of raisins, figs, prunes, and dried currants. Whence do they come, how are they prepared for market, and what is their use and value as food?

19. (*Men only.*) Write out Euclid VI. 8.

What is the connection between this proposition and Euclid VI. 13, Euclid II. 14, Euclid III. 31, and Euclid III. 35, Case 2?

(*Women only.*) Simplify

$$\frac{\sqrt{25{\cdot}4016} - \sqrt{1{\cdot}0609}}{\sqrt{25{\cdot}4016} + \sqrt{1{\cdot}0609}}$$

Ans. $\frac{401}{607}$.

MODERN EDUCATIONAL REFORMERS.

BY THOMAS CARTWRIGHT, B.A., B.SC. (LOND.),

Author of 'Mental Science and Logic for Teachers.' Late Director of the Birkbeck Training Classes and Lecturer therein on School Method.

No. XIV.—MARIA EDGEWORTH.

'*Je voudrais,*' (writes Rousseau, 'Emile,' Book iii.), '*qu'un homme judicieux nous donnât un traité de l'art d'observer les enfants. Cet art serait très-important à connaître: les pères et les maîtres n'en ont pas encore les éléments.*'*

THIS experimental method of arriving at educational guides and beacons is now happily pursued by many, but in the days of the 'Emile,' men theorised and dogmatised without any exact knowledge of child life; hence praise is due to any who, however imperfectly, strove to arrive at the principles of education by way of experiment and observation.

Wherefore we give a place in our gallery of educational worthies to the author of 'Practical Education.' This book was published in 1798, being issued in two large octavo volumes, the product of the patient observation of Richard Lovell Edgeworth and his daughter Maria. Of her father, we may admire the devotion to the education of the many children resulting from his four marriages, whilst ignoring that bombastic pretension which is always such a reliable proof of the absence of genius and true worth. As Byron truly said, 'The fact was, everybody could be interested in *her*. She was a nice little unassuming "Jeanie Deans" looking body, as we Scotch say, and, if not handsome, certainly not ill-looking. Her conversation was as quiet as herself. One could never have guessed that she could write her name; whereas her father talked, not as if he could write nothing else, but as if nothing else was worth writing.' The Edgeworths were an Irish family, although Maria was born—on the 1st January 1767—at Black Bourton, near Oxford. After his second marriage, the father settled on the family estate at Edgeworthtown, County Longford, Ireland, Maria being sent to school at Derby. During the life of her father and after his death the dominant feeling in Maria's mind was belief in the genius of her father, next to which may be placed an equally strong disbelief in herself as possessing much out-of-the-way capacity. Her own judgment in comparison to that of her father was nought, a fact which, however creditable to her filial love, was not condusive to excellence in her writings, upon which the fire of parental criticism and advice had a cramping and stultifying effect.

The life of our authoress can be written in few words. Dearly devoted to home and family her tramps abroad were not numerous—two or three visits to London, the same number to France and Switzerland, and a visit to her friend, Sir Walter

* 'I wish that some discerning person would write a treatise on the art of observing children, to know which would be of great service, but of which parents and schoolmasters alike are ignorant even as to the first rudiments.'

Scott—these were the nearest approaches to excitement that Miss Edgeworth experienced. Even her love affair with M. Edelcrantz, the private secretary of the King of Sweden, was not permitted to interfere greatly with the quiet flow of her existence, and when this subdued romance was brought to an expedient conclusion, because Maria would not renounce her family for life in Sweden, there did not seem to be much disturbance in the life of that lady. She herself says of her life: 'As a woman, my life, wholly domestic, cannot afford anything interesting to the public; I am like the "needy knife-grinder," I have no story to tell.' Still, when on May 22nd 1849 a period was put to her existence, she left behind her the record of a life made happy by devotion to others, rendered beautiful by an entire absence of anything like assumption, unblemished by any taint of vice, and endeared to the remembrance of all time by the constant attempt to elevate and amuse young and old, and especially young. The severest reproach of her critics constitutes her highest claim to praise, viz., that her aim was utilitarian. Unlike many of our "new women," she was not able to satisfy her conscience unless she felt that she was attempting to put some folly out of existence or infuse new life and influence into some virtuous practice. For this reason alone might we include her in our gallery, but her educational work was of a more direct nature, nor was it limited to the two volumes of 'Practical Education' that were written in collaboration with her father. She shares with Mrs. Trimmer, Mrs. Barbauld and Mrs. Day, the honour of having attempted to educate children by amusing them. Her children's books were many, but in all of them the educator was skilfully and unobtrusively present. Work in play and play in work was ever her motto; nor is this the only instance of her insight into true educational method. The claims of science received full recognition at her hands, and especially was she anxious to make children independent in observation, in thought, in judgment and in virtue. As her biographer (Miss Zimmern) says, 'The main idea and the chief merit of these volumes, not at once perhaps obvious, is that of enforcing in a popular form *the necessity of exercising the faculties of children*, so that they should be, in fact, *their own instructors*, and of adding to those more common incentives to study which consists of rewards and punishments, the far surer, nobler, and more *effective stimulus of curiosity kept alive by variety and the pleasure of successful invention*. It was the desire of the authors to show with what ease the faculty of thinking may be cultivated in children, a point on which Miss Edgeworth insists in other of her tales. In 'Harry and Lucy' are explained, simply and familiarly, sometimes in conversation between the children and their parents and friends, sometimes in dialogue between the children themselves, the rudiments of science—principally chemistry and physics—and the application of these to the common purposes of life. . . . . Miss Edgeworth in 'Harry and Lucy,' as a whole, succeeds in rousing her reader's curiosity without making them suspect design. Thus the leading principles of science are unfolded in familiar experiments which give young learners the delight they would have in playing some interesting game, exercising their ingenuity without tiring them.

Let us now turn to the book upon which the educational fame of Miss Edgeworth and her father rests. 'Practical Education' was issued in two quarto volumes in 1811. It is now out of print, and we would here express our indebtedness to the courtesy of Messrs. Routledge, the publishers of Miss Edgeworth's works, for volunteering to place at our disposal a copy of this rare work, of which offer we gratefully availed ourselves in making the following excerpts. The nature of the work is evident from a perusal of the preface: 'To make any progress in the art of education, it must be patiently reduced to an experimental science; we are fully sensible of the extent and difficulty of the undertaking, and we have not the arrogance to imagine that we have made any considerable progress in a work which the labours of many generations may, perhaps, be insufficient to complete; but we lay before the public the result of our experiments, and in many instances the experiments themselves.' Again, 'We have found from experience, that an early knowledge of the first principles of science may be given in conversation, and may be insensibly acquired from the usual incidents of life; if this knowledge be carefully associated with the technical terms which common use may preserve in the memory, much of the difficulty of subsequent instruction may be avoided.' Chapter I. deals with toys, the following truly Kindergarten principle being clearly enunciated: 'The first toys for infants should be merely such things as may be grasped without danger, and which might, by the difference of their sizes, invite comparison; round ivory or wooden sticks should be put in their little hands; by degrees they will learn to lift them to their mouths and they will distinguish their sizes; square and circular bits of wood, balls, cubes and triangles with holes of different sizes made in them, that admit the stick, should be their playthings.' Both Pestalozzi and Froebel would readily frank this contention, which is simply an earnest of the whole of the chapter, wherein picture reading and drawing are warmly advocated. Few will traverse the statement, occurring a few pages later on, that, 'It is surprising how much children may learn from playthings when they are judiciously chosen, and when the habit of reflection and observation is associated with the ideas of amusement.' Gardening receives strong recommendation, a course strictly in accord with the latest ideas as to school practice and procedure, nor is a reference to manual training wanting, whilst the modern tendency to make haste slowly with respect to the teaching of reading is thus referred to: 'Some people are so struck with a panic fear lest their children should never learn to read and write that they cannot be in too great a hurry to teach them.' This occurs in the chapter on 'Tasks,' an early portion of which lampoons right yeomanly the alphabetic system of teaching to read, the alternative phonic system being just as earnestly commended. The prophecy that 'half a century hence the common method will probably be exploded' is unfortunately not quite in accordance with reality. The evil of accepting a knowledge of words as proof positive of a possession of the corresponding ideas, as well as the folly of teaching rules before language, instead of *vice versâ*, are touched upon in a manner worthy of Spencer, whilst the chapter on 'Attention' is unquestionably

good reading, 'one thing at a time' coming in for much approval, and Major Cartwright's Esquimaux, who were disgusted with the 'too much everything' that expressed the impression made on them by their walk through London's streets, being quoted as a good example of the nausea and mental stagnation that proceed from the attempt to subvert this time-honoured precept of pedagogic procedure.

Concerning rewards and punishments our authors are commendably up to date. 'By giving few commands or prohibitions, we may avoid the danger of either secret or open disobedience. *By diminishing temptation to do wrong, we act more humanely than in multiplying restraints and punishments.*' Let not the weakling who gives way to anger deceive himself in thinking that his emotion will be mistaken for the more legitimate indignation, since '*a child distinguishes between anger and indignation very exactly; the one commands his respect, the other raises his contempt as soon as his fears subside.*' 'Whenever the indignation expressed against any fault appears in the least to pass the bounds of exact justice, the sympathy of the spectators immediately revolts in favour of the culprit; the fault is forgotten or excused, and all join in spontaneous compassion. In public schools this happens so frequently that the master's displeasure seldom affects the little community with any sorrow.' 'Every preventive which is discovered for any defect, either in manners, temper, or understanding, diminishes the necessity for punishment; *punishments are frequently the abrupt, brutal resources of ignorance* to cure the effects of former negligence. . . . . As for corporal punishments, they may be necessary where the boys have to be drilled in a given time into scholars; *but the language of blows need seldom be used to reasonable creatures.* The idea that it is disgraceful to be governed by force should be kept alive in the minds of children; *the dread of shame is a more powerful motive than the fear of bodily pain.* To prove the truth of this, we may recollect that few people have ever been known to destroy themselves in order to escape from bodily pain; but numbers, to avoid shame, have put an end to their existence.' The whole of Chapter X. is devoted to 'Sympathy and Sensibility,' a fact again proving that 'Practical Education' is not wholly ignorant of the electric effect of a flash of fellow feeling in the narrow sphere of the schoolroom as in the wider circle of the out-of-school world at large. The extreme sensibility of children is practically ignored with lamentable frequency, more especially by those teachers who, either by nature or from long repression, are almost destitute of that sympathy which alone is qualified to soothe and allay the morbid mental condition due to childish sensitiveness. Again, then, it must be conceded that Miss Edgeworth and her father were pointing the way towards a newer and a better education in dwelling upon the reality and universality of sensibility, and the crying need for the application of its natural antidote—sympathy. 'Vanity, Pride, and Ambition' is the heading of the eleventh chapter, nor will the reader deny the propriety of a study of these emotions from which so many child-actions proceed. Volume I. concludes with a more or less chatty discourse on books, and their place and importance in the economy of education.

Of Volume II. we can, alas! only give the table of contents, much as we should like to dwell upon a few of the chapters.

Chap. XIII. On Grammar and Classical Literature.
" XIV. On Geography and Chronology.
" XV. On Arithmetik.
" XVI. Geometry.
" XVII. On Mechanicks.
" XVIII. Chemistry.
" XIX. On Public and Private Education.
" XX. On Female Accomplishments. Masters and Governesses.
" XXI. Memory and Invention.
" XXII. Taste and Imagination.
" XXIII. Wit and Judgment.
" XXIV. Prudence and Economy.
" XXV. Summary.
Appendix. Notes containing conversations and anecdotes of children.

As above noted, Miss Edgeworth wrote many children's books, the best being 'Harry and Lucy,' which, under the guise of anecdote and story, were intended to supplement and exemplify the principles of education so ably enunciated in the two volumes of 'Practical Education.' This book is easily obtainable, and we commend it to our readers as a good example of a didactic child's book.

Educationists have not been over eager to acknowledge Miss Edgeworth's undoubted claim to remembrance. Our pleasure, therefore, in calling attention to one who was an earnest and persistent worker in the good cause is all the more keen. As to gratitude, 'Practical Education' itself warns us to be patiently patient in our expectations in that direction. 'Gratitude is one of the most certain, but one of the latest, rewards which preceptors and parents should expect from their pupils.' With a little adaptation, this might be applied to educational reformers and the teachers whom their labours ultimately benefit.

NOTES AND NOTIONS.

BY RICHARD WADDINGTON.

THE last Lancashire Conference was remarkable for the phenomenal amount raised for the charities. In 1895 Lancashire will have a second opportunity of showing its practical interest in the cause of benevolence. Next month the zealous efforts of the Manchester Committee are to show what the newly-created 'seaport' can do. St. James's Hall, from November 20th to 24th, is to be the scene of the Conference Bazaar. Everything is to be on that gigantic scale which evidences complete confidence in the result. May the result be beyond the anticipations of the most sanguine of the many earnest workers, who forcibly maintain—

'Calamity is man's true touchstone.'

Every teacher, aye, and every teacher's friend, who is within a thousand miles of Cottonopolis, might do worse than pay a visit to St. James's Hall next month, when well burdened stalls will bear ample testimony to many hours wrought in the noble cause of charity. Come one, come all, and bring your friends with well filled p——s.

Scholar, reading, is stopped by H.M.I., and asked, 'What is a civilised person?'

Scholar: 'An educated person.'

Inspector: 'No, one who lives in a city.'

I am changing my abode. Bolton is only a county borough.

* * * * *

The *Head Teacher* has an article on 'Sample' examination, from which I extract the following:—

Three hundred children must perforce be examined by *three Inspectors* in *three hours*. 'Hurry up!' Let the reading be sampled; put a question or two to elicit intelligence; jot down now and again a stupid answer, and then guess whether the other two-thirds are probably like these. Give some sums and problems to another third, and dictate a sentence to be written by the remainder of the children. Tot up how many sums and problems are right, how many wrong; how many errors in spelling; and what about the writing? Turn over the leaves of a few copy books. Fancy what the rest are like, and draw upon your imagination for the probable number of sums and problems that would have been correct *if all* the boys had worked them, as also the possible number of blunders in spelling that *might* have been made. 'Have you heard the recitations?' 'Not all, but have taken a sample here and there.' 'Hurry up!' 'Who took the class singing?' 'How did the boys answer?' 'Intelligently! Eh?' 'Any specifics?' 'What a time they take!' 'Who heard the singing?' 'Who saw the drill?' and so on. 'Yes, I see'—'Only moderate all round.' 'Class subjects, fair.' 'More attention to three Rs.' 'Order needs watching.' (One boy knocked a fly off his nose when his hands should have been behind him.) 'Must make an example here.' And so in a month's time a loud report is heard—the game is brought down—very small game to be sure, but it is the familiar and well-beloved cock robin of the district, and those who found him crumbs enquire

Who killed Cock Robin?
I, said the Inspector,
The small bird's protector,
I killed Cock Robin.

'The Fly,' who saw it.

The *Board Teacher*, in the extracts from latest reports by Her Majesty's Inspectors on London Board Schools, gives the following by Mr. A. P. Graves:—'Points needing attention have been talked over with the Head Mistress.' One can understand—

'The lowering element
Scowls o'er the darkened landscape'

around Whitehall, as the typewriter prints this model sentence for a school report. If this spirit becomes general, the clerks at the Education Department may yet get eight hours a day, and the anxious fear of breaking the seal of the ominous missive that follows Her Majesty's Inspector's visit disappear. Who can tell? Probably we are near the end of long, hypercritical reports.

* * * * *

The result of the London School Board contest will be a matter of history ere the next 'Notes and Notions' are penned. Messrs. Macnamara, Gautrey, and Horobin are nearly certain to form part of the next Board. Unfortunately the policy of the present majority has made it impossible for teachers to look to one party with favour. But the contest will be a severe one. Despite the condemnation of their own party Churchmen will 'fall in' at the ballot box. The disgust with their own leaders is not stronger than their distrust of the opposite party on the Board. But teachers, whether belonging to the 'Diggleite' party or the opposite party, have a 'bone to pick' with the present majority that for the moment overshadows all political inclination.

Once more the Queen's Scholarship list is engrossing the attention of the coming race of teachers. To Miss J. Dunn and Mr. John W. Muckle I offer my hearty congratulations. Year by year the contest grows more severe, and it is gratifying to find Liverpool first in the list of women, while Hull takes second place among the men. To those who find the accommodation at the colleges insufficient, and are therefore debarred from using their scholarships, and to those whose names don't appear on the list, I offer the consolation of the Lancashire Burns, Edwin Waugh,

'There's some are creepin eawt o'th slutch,
An' some are getting deawn i'th doitch;
Bi th'mon, aw never yerd of sich
A world for change o' fortin'!'

* * * * *

And touching the want of training college accommodation, it must appear that some step must be taken to ensure a reasonable opportunity for the capable. Take the 120 applicants for entrance to Borough Road Training College who succeeded in obtaining places in the first and second class. There are only 66 vacancies. Many of the other 54 must seek admission elsewhere. The denominational establishments will not take them because they have not taken the Scripture examination, and therefore many of them will be unable to gain admission to any training this year, while hosts of others, below them on the list, will find ready acceptance because they have taken the religious examination. At present our system of training is sadly behind the age. There are 1,314 men in the first and second classes, and a little over 900 vacant places. The women who passed in the first and second classes number 3,029, and there are 1,117 vacant places. When will the State take the question seriously in hand?

* * * * *

The Statutory Meeting of the Educational Institute of Scotland was remarkable for the bestowal of the 'Fellowship' on two of the Union's leaders. Messrs. Ellery & Macnamara will bear the Institute's honours with dignity and ability. The fraternal greetings of the Scotch teachers could hardly have been more fittingly conveyed across the border. That the Scotch teachers heard of superannuation from Mr. Ellery is only as certain as that Mr. Machamara told all about the capricious dismissal of teachers on this side the Tweed. May the recipients long live to enjoy the pleasure of donning the hood and gown which accompanies the addition to the cognomen of F.E.I.S.

* * * * *

In visiting a local association not far remote from a busy Lancashire town, I came across a teacher who works single handed in a school of 30 scholars, including infants. And yet her happy contentment seemed to say—

'Never tell me that childer are tiresome;
They're th' best little craiters alive.'

In addition to the rural difficulties this mistress is daily face to face with the half-time difficulty. She is still more severely handicapped than would be a master under similar conditions, for he would have the needlework taken off his hands. And after talking over Object Lessons, Physical Exercises, and Varied Occupations, I returned to my 'native heath' a sadder but a wiser man. The expenditure of a few

millions on an ironclad, or the voting of a few millions for the strengthening of the army, would rouse the enthusiasm of John Bull to a high pitch. But a demand for financial aid to this type of school would be met with almost painful indifference, if not strenuous opposition.

* * * * *

And this brings me to the question of Rate aid—*the* question for the Manchester Conference. It will be remembered that the Oxford Conference instructed the Executive to prepare a scheme to be submitted to the local Associations before the end of the present month. The Executive has done its part of the task, and the scheme is at present being submitted to the local Associations. The scheme is not a rate-aid scheme, and it is not to aid any one class of schools in particular. The aid is to be State aid. With this everyone who looks fairly at the question and the issues involved must agree. Rate aid, pure and simple, would mean in a large number of cases the creation of a rate which does not at present exist, and, in other cases, a reduction of the educational efficiency of the present rate-aided schools to the danger of all schools. Take Bolton, where the rate is 9*d.* at present. The School Board educate less than half the children. To include the other, taking into account the structural alterations that would be demanded, the rate would nearly double. Would the ratepayers allow this? I trow not. The result would be a shilling rate at the outside.

* * * * *

The Executive scheme, therefore, advocates a direct fixed grant of ten shillings per scholar in average attendance, which is to count as income in meeting the seventeen and sixpenny limit. The grant is to be made to all schools, Board and Voluntary, and is to be given on the fulfilment of certain conditions. There must be a properly elected body of managers, some of whom must be chosen by the Education Department. The accounts must be open to a public auditor. The grant must not be used to relieve other sources of income, except where the educational equipment is satisfactory.

* * * * *

Let me for a moment deal with the last important condition. It can best be illustrated from two local authorities. One has a high educational standard. The schools are well-equipped, and the education efficient. The rate in this place is high, probably one shilling. Near by another local authority, with a low ideal in matters educational, has poorly equipped schools and a threepenny rate. The ten shilling grant will do much to improve the latter, and in the former the locality will find relief from some of the burden it has generously borne. Exactly in the same way the generous Voluntary School managers will obtain relief in the grant of ten shillings, whereas the badly equipped will get better conditions than formerly. The scheme is in no sense Utopian, and if it receives the approval of the Union will place a serious responsibility on any Education Minister who refuses to consider it seriously.

* * * * *

Voluntary school teachers are, at present, seriously handicapped. But they must not forget that their confrères in many School Board areas are equally at a disadvantage. The fact that the scheme metes out equally to all kinds of schools will do much to make it acceptable in quarters from which the most strenuous opposition is to be expected. As a voluntary teacher, I would fight most strenuously against any scheme which reduced the efficiency of the Board School, because I feel sure that such a reduction would very speedily mean the lowering of the equipment of the Voluntary Schools. The Special Committee of the Executive has devoted much time and ability to the scheme, and I commend it to the careful consideration of every member of the N.U.T.

* * * * *

The requirements in Drawing for the standards are excessive—especially in the upper standards. Somehow an idea has got abroad that Standard I. must do their *work on paper;* this is not the statement in the Science and Art Directory. It is there stated that the *children may do their work on slates or paper as the managers decide;* but beyond and above this there is no doubt that the teaching of the drawing of the fourth and standards above the fourth is as difficult and requires as much ability as the teaching of the three R's. The difficulty is becoming more apparent because only now are a large number of schools reaching the work of the upper standards. The work that now carries a scholar through the sixth standard with a certificate of merit would, prior to 1885, have earned Second Grade Certificates in Freehand, Model, and Geometrical Drawing. The scale of Standard IV. requires simplification, and it wants dividing between the fourth and fifth standards. The geometry of the fifth requires moving to the sixth, and the geometry of the sixth to the seventh. The light and shade exercise of the seventh wants removing from the syllabus.

* * * * *

The Federation of Assistant Teachers will meet at Birmingham on the 27th inst. The programme is extensive, if not exciting. Mr. A. Croft may be trusted to uphold with dignity the presidential chair. After Derby and Nottingham the Birmingham Conference seems likely to pale. This is only to be expected. No organisation can afford continuous fireworks. Domestic matters must receive some attention. However, I wish the Confederation a successful 'Annual.'

* * * * *

When will the Object Lessons and Varied Occupations be required to obtain the higher principal grant? The Code says after August 31st, 1895. Does that mean that all schools whose examinations fall due after next August must present Object Lessons and Varied Occupations? Or, does it mean that the teaching of these subjects must commence from that date? And the next point is, how many Varied Occupations will satisfy the requirements? Will one in each of the first three standards be sufficient? Perhaps we shall gather this information when the deputation waits on Mr. Acland shortly.

* * * * *

Liverpool and Birmingham are to have teacher candidates at the School Board Election, I hear. What about Manchester? Has the demand for a teacher on the School Board disappeared with the publication of the list of salaries paid by the Board?

LONDON MATRICULATION.

PREPARATION CLASS FOR JANUARY, 1895.

BY R. C. B. KERIN, B.A. (LOND.),
First in First-Class Classical Honours at Final; Principal, Carlyon College, Chancery Lane, W.C.,
AND E. J. SCHWARTZ, B.A. (CAMB.),
Mathematical Scholar and Honoursman in Tripos.

LATIN.

Latin Course for November.

1. Vergil, Aeneid V., lines 602–800. Revise lines 249–452, Book V.

2. Grammar: Postgate's Latin Primer (Cassell), §§ 393–415; or Allen's Latin Grammar (Clarendon Press), §§ 143–146; §§ 199, 200; §§ 282–289; § 297; § 300.
Revise the declensions again, the pronouns, the infinitives, and gerundives. Those that have not done the grammar papers in the back numbers should do them now when revising.

3. Translation at sight: a couple of pieces a week.

4. Bayfield: Exercises 24–80, the 14th in each.

Notes on Vergil, V., 452–605.

Additional Notes.

455. *Viris.* Words of the third declension that have the genitive plural in *-ium* have the accusative plural in *-is* in Cicero, Vergil, etc.

456. *praecipitem agit*, 'drives headlong.' Note that *princeps* has genitive *principis*, *auceps aucupis*, and *praeceps praecipitis*.

460. *creber*, 'frequently,' adjective where we use adverb.

462. *passus* = *passus est*.

466. *viris alias; alias* is also taken in the sense of 'changed,' *i.e.*, 'increased.'

469. *Iactantem utroque caput*, 'swaying his head from side to side.' (Mackail.)

473. *animis* is abl. of respect or means, lit. 'in respect of,' or 'by his spirits.'

475. *Cognoverint* is subjunctive in a dependent question. The direct question would be, '*quae fuerunt iuvenali in corpore vires?*'

476. 'from what a death you recall and save Dares,' lit. 'from what a death you save Dares recalled.'

489. *mālo*, from *mālus*, m., 'a mast.'

490. *Convenere.* Beginners should be careful not to confuse this alternative form of the 3rd plural perfect indicative with the ending of the infinitive.

491. *galea.* The lots were placed in a helmet.

492. *exit*, 'leaps out.'
locus, the place for the lot fixing the place (Conington.)

497. *torsisti primus*, 'wert the first to hurl.'

498. *ima galea*, 'at the bottom of the helmet.'

499. *et*, 'even.'

500. *quisque* is in apposition to *viri*, '*quisque pro se*,' 'each as best he could.'

501. *pharetris*, 'from the quivers,' ablative of separation after *depromunt*.

503. Learn patronymic endings in the grammar.

504. *Vēnit*, pres. indicative, to be distinguished from *vēnit*, perf. indic.

506. Learn declension of *ales*.

508. *Tetendit*, used in two senses; this is a good instance of *zeugma*. See last month, note on l. 341.

511. *quis* = *quibus* = 'by which,' abl. of instrument; *innexa pedem*, lit. 'having its foot bound.'

512. *notos*, acc. plural of *nŏtus*, the south wind. Avoid confusing it with *nōtus*, 'known.' The scansion shows that *o* is short.

514. *in vota vocavit*, 'called E. to hear his prayers.'

522. *magnoque futurum augurio*, 'to be a great augury,' lit. 'for a great augury'; *augurio* is predicative dative.

542. *Quamvis* in Cicero is followed by the subjunctive.

553. *pariter*, 'side by side.'

554. *quos omnis*, 'all of whom'; *omnis* is acc. plural. See above, l. 455.

556. *in morem*, 'in accordance with the custom.'

556. *tonsa* and *corona* are ablatives.

557. *bina*, 'two each'; *praefixa*, 'tipped.'

558. *lēvis*, 'smooth,' *not līvis*, 'light,' as the scansion shows. *levīs* is acc. plural agreeing with *pharetras*.

560. *Terni* has not its distributive force here, it is merely equivalent to '*tres*.'

561. *bis seni.* In multiplication the distributive numeral is used.

562. *paribus magistris*, according to Conington, means that each company had its independent captain.

570. *forma*, abl. of respect 'in beauty.'

580. *olli*, archaic form for *illi*.

582. *Convertēre*, 3rd plural perf. indic. active, not *convertĕre*, which would be pres. inf.

584. *adversi spatiis*, 'opposed in the lists.'

585. *pugnaeque simulacra*, 'the imagery of battle.'

590. *iter* and *dolum* are objects of *habuisse*. The puzzle or maze (*error*) is said by Vergil to baffle the marks (*signa*), instead of baffling the person who made the marks.

593. *Similes* is followed by either genitive or dative.

594. *nando*, 'by swimming,' abl. of gerund used to express the means.

599. *quo* = *quo modo*.

601. *Honorem*, 'observance.' (Conington.)

603. *Tmesis* is the separation of the component parts of a word, as here, *hac...tenus*. This is always the case with *ne... quidem*, 'not even,' and often with *antequam*, *postquam*, etc. *Hactenus*, 'up to this point,' 'so far.'

Notes on Latin Grammar.

(*September Course.*)

Students should know the different usages of *haud*, *non*, and *ne* to express 'not.' *Ne* is used in wishes and prohibitions. *Haud* is normally used before adjectives and adverbs. Note, however, the use of *haud* with a verb in the phrase *haud scio an*, 'I am inclined to think.' The various interrogative particles used in asking questions are important. Distinguish the different methods of translating 'whether . . . or' in a question. Remember that 'whether . . . or' in an adverbial clause is translated by '*sive . . . sive*.' In some cases it is hard to tell whether the clauses are adverbial or not. The best test seems to be this: If you can take away the 'whether . . or' clause, and leave the sense complete, then the 'whether . . . or' clause is adverbial. If, however, the absence of the clause would leave the sense incomplete, then the clause is an interrogative one and *utrum . . . an* must be used. Note the differences between *num*, *ne*, and *nonne* in asking questions. Remember that *an* is not used in the *first* portion of disjunctive questions. Where *an* apparently is used in this way, there is always an ellipse of the first alternative. Postgate notices some cases in which the tense of the indicative in Latin differs from the tense in English. *Postquam* is followed by the perfect indicative instead of the pluperfect, if the exact time after is not mentioned; *e.g.*, *postquam cenavimus, Atticus advenit*, 'after we had dined Atticus came.' Again, after the words *si*, *cum*, *donec* (until), etc., when the principal verb is in a future tense, the future is used in Latin when the time of the actions expressed by the principal sentence and the dependent sentence is the same; *e.g.*, *hoc faciam cum potero;* we say 'I shall do this when I can.' *Hoc faciam cum possum* would be bad Latin. If, however, the action of the dependent clause is antecedent to that of the principal clause, use the future perfect indicative in the dependent clause; *e.g.*, *non respondebo donec tacueris*, 'I shall not answer till you are silent.' Here the silence begins before the answer is made, and as the verb of answering is in the future, the verb of silence will be in the future perfect.

The rule for the sequence of tenses must be thoroughly known and *applied*. I need not lay stress on the fact that knowing a rule is one thing, and applying it another. There is, perhaps, no rule which is so often disregarded even by men who have been a considerable time at Latin. I have often alluded to it in the sentences; I shall, however, sum it up again. This rule regulates the tenses of the subjunctive to

be used in dependent clauses. If the verb in the principal clause is in a secondary or historical tense (*i.e.* the imperfect, pluperfect, aorist perfect), the imperfect or pluperfect subjunctive is to be used. If the principal verb is in a primary tense (*i.e.*, present, future, future perfect, perfect subjunctive, and imperative), use either the present or perfect subjunctive. The historical present will be followed by either primary or secondary sequence.

Latin Test Paper.

(1) Give the perfect and pluperfect indicative 3rd sing., the perfect infinitive, the future participle nominative feminine singular, and the perfect subjunctive 2nd plural of *proficiscor, opperior, meto, metior, ordior, fungor, haurio, nascor, morior, fundo, abigo, tundo, surgo, sugo, veho.*

(2) What are the usages of the subjunctive in independent sentences?

(3) How are prohibitions expressed in Latin?

(4) Explain what is meant by gerundial attraction? What classes of verbs have no gerundive?

(5) Mention any case in which the subject of the infinitive is in the nominative case.

(6) Correct or justify :—

(*a*) Albior est quam nivem.

(*b*) Duo mille equites hostibus interfecti sunt.

(*c*) Ne hoc face in aestate ('Do not do this in summer').

(*d*) Omnes nostrum hoc fecisse potuerunt.

(7) Distinguish :—*ācer* and *ăcer; vltium* and *vltium; vīri* and *vĭri; vis* and *vires; copia* and *copiae; impedimentum* and *impedimenta; hostis* and *inimicus; duo* and *bini; nequaquam* and *nequicquam; nusquam* and *nunquam; quisque* and *qvisquis; alter* and *alius; num* and *nonne* (in questions); *quis* and *uter* (which).

French Course for November.

(1) Six pages of translation a week, with a certain amount of written translation.

(2) Grammar: Fasnacht, §§ 102–107, § 123. Revise the formation of the plural and feminine, as well as the four regular conjugations, with the irregular verbs of the first conjugation.

French Test Paper.

(1) Give 1st and 3rd singular, and 2nd and 3rd plural present, past definite, and future indicative active, the 2nd singular present imperative and imperfect subjunctive active of :—*cueillir, pouvoir, envoyer, valoir, prévaloir, maudire, médire, redire, peindre, s'asseoir, rire, faire, ouvrir, vêtir, coudre, croître, croire, vivre, naître.*

(2) Translate into French :—*a windmill; a milk jug; she has hurt her hands; this day fortnight; fifteen days ago; what is the matter with you?* (1895.)

(3) Give the rules for the formation of adverbs in French, Form adverbs from :—*joli, gentil, prudent, lent, traître, complet, vieux, bon, pire, bref, heureux, obscur, précis, haut, faux, sage, instant.*

(4) Distinguish :—*avant, devant,* and *auparavant; vieux* and *ancien; midi* and *minuit; ailleurs* and *d'ailleurs; de bonne heure* and *à la bonne heure; la même chose* and *la chose même; chaque* and *chacun; dû* and *du.*

(5) Turn interrogatively-negatively the following :—

(*a*) Votre père ne s'en va pas avec moi.

(*b*) Il court des bruits désavantageux sur son compte.

(*c*) Le peuple juif est dispersé par toute la terre.

(6) Turn into the plural :—

(*a*) La lettre que j'ai présumé que tu recevrais est enfin arrivée.

(*b*) Il parla de manière à convaincre le juge de son innocence.

(*c*) Il a acheté un cheval de race.

(*d*) Je vois son livre et celui de son frère.

(7) Correct or justify :—

(*a*) Je n'ai pas du pain.

(*b*) Personne est supérieure.

(*c*) Chacun homme a le vu.

(*d*) Ne donnez-moi pas cela.

(*e*) Dont parlez-vous?

English Course for November.

(1) Hewitt and Beach, pp. 633–676; or Morris's Outlines of English Accidence, Chapters II. and VII.

Reference should also be made to Skeat's Primer. The modified form of Grimm's Law will be found there, as well as Verner's Law. Next month we shall give a brief summary of this, and also give the notes which we intended to give this month on the Alphabet, the Periods of English, and Modern Spelling.

HISTORY.

Notes on the reigns Henry VII.—James I.

In the reign of Henry VII. note his claim to the Crown, the condition of Parliament, and the causes which brought about the Tudor despotism. The two insurrections, one associated with Lambert Simnel, the other with Perkin Warbeck, are important features. Students should be able to discuss the Star Chamber, its advantages and disadvantages. Note the Question of Livery and Maintenance. The war with France should be known. In the reign of Henry VIII. the careers and policies of Wolsey, Sir Thomas More, Cranmer, and Thomas Cromwell, are most important. Be able to trace the causes and progress of the Reformation in this reign; the history of the divorce proceedings; the foreign policy. Note especially the Field of the Cloth of Gold; the battles of Guinegate and Flodden; the New Learning; the Amicable Loan; the King's various marriages; the Acts of Treason and Supremacy; the dissolution of the smaller and larger monasteries; the Pilgrimage of Grace; the Six Articles; affairs in Ireland. In the reign of Edward VI. note the careers of Somerset and Warwick; Ket's rebellion; the various Prayer Books and progress of the Reformation. Be able to discuss the state of religious questions in the reign of Mary; Spanish match; the loss of Calais. In Elizabeth's reign note the difficulties that confronted her on her succession to the throne; the Acts of Uniformity and Supremacy; the rise of the Puritan party, and Elizabeth's attitude towards them. Mary Queen of Scots, her claims to the English throne, her disputes with Knox; the Treaty of Edinburgh; danger to Elizabeth from Scotland; the marriage between Mary and Darnley; murder of the latter, and Mary's marriage with Bothwell; Mary's flight into England and hearing of her case before the Commissioners; various plots to liberate Mary—Northumberland's plot, Ridolfi plot, Norfolk's plot, Babington's plot; execution of Mary; Spanish war, 'Singeing of the King of Spain's beard'; the Invincible Armada; influence of the mariners and pirates; Court of High Commission; Irish troubles; Elizabeth's favourites—Leicester, Raleigh, Essex; rise of Lord Bacon.

Greek Course for November.

(1) Iliad xxiv., 750 to the end. (Leaf's Edition, Macmillan's Elementary Series.)

(2) In grammar learn thoroughly the verbs in -μι, and the irregular verbs given in the alphabetical list from α to ρ. In the Syntax read up the Pronouns, the uses of the Article, notes on the Tenses, and the use of the Middle Voice.

3. Two pieces of translation at sight a week, and some exercises in Heard's Exercises (Macmillan), which will make you familiar with the formation of the verbs.

MATHEMATICS.

Arithmetic Course for November.

Stocks should be carefully read up this month.

Note the following points :—

(1) £7,900 stock is equivalent to 79 shares of a stock which was originally sold at £100 per share.

(2) 5 per cent. stands for £5 per share (of original value of £100).

(3) When a broker charges ¼ per cent., the price of each share is increased to the purchaser by £¼.

Thus, if a person sells stock at 84⅛, paying ¼ per cent. brokerage, he will only receive £84¼ per share from the broker; also if he buy stock at 83¼, he will have to pay £83½ per share to his broker.

To illustrate these principles we append a few examples:—

(1) A person invests £9,500 in 3 per cent. stock at 95, what is his income?

Here £9,500 is expended in buying shares at £95 each.

Hence number of shares $= \frac{9500}{95}$;

3 per cent. is paid, *i.e.*, £3 per share.

Hence income $= \frac{9500 \times 3}{95} = £300$.

(2) A person has a certain amount of 4 per cent. stock, he sells it £117½, and invests half the proceeds in 2 per cent. stock at 96, and the rest in 3 per cent. stock at 99. He then finds that his income is reduced by £20; what amount of the original stock had he? (Jan. 1887.)

Let x = number of shares he had in the original stock.

Then £$4x$ = his original income since the stock pays £4 per share.

He sells at £117½ per share = £$\frac{352}{3}$ per share;

and ∴ he gets £$\frac{352x}{3}$ for all his shares.

Half of this, or £$\frac{176x}{3}$, he invests in stock at 96;

and hence gets $\frac{176x}{3 \times 96}$ or $\frac{11x}{18}$ shares, yielding an income of £$\frac{11x}{9}$ (since stock pays £2 per share).

The latter half is invested in 3 per cent. stock at 99, yielding an income of $\frac{176x \times 3}{3 \times 99}$, or £$\frac{16x}{9}$;

∴ total income in 2nd case $= \frac{11x}{9} + \frac{16x}{9} = 3x$.

But his original income was $4x$;

hence $4x = 3x + 20$;

∴ $x = 20$;

or he had 20 shares of the original stock.

Algebra Course for November.

A revision of the earlier parts of the Algebra is advisable, and practice in working miscellaneous examples, or trying some of the papers set at previous examinations.

We append a few examples, which should be carefully worked through, as we omit the details of the work.

(1) Find a value of x which will make the expressions $6x^3 - x^2 - 20x + 12$ and $6x^3 - 13x^2 - 21x + 18$ both vanish.

We first find the H.C.F. of these two expressions by the ordinary method to be $3x - 2$.

Hence $3x - 2$ is a factor of both expressions;

∴ if $3x - 2 = 0$, both expressions will vanish, that is when $x = \frac{2}{3}$.

(2) Prove $(x - 3y)^3 + (2x - y)^3 + (4y - 3x)^3 = 3(x - 3y)(2x - y)(4y - 3x)$.

By means of the formula

$$a^3 + b^3 + c^3 - 3abc = (a + b + c)(a^2 + b^2 + c^2 - ab - ac - bc)$$

we see that

$$(x - 3y)^3 + (2x - y)^3 + (4y - 3x)^3 - 3(x - 3y)(2x - y)(4y - 3x)$$
$$= [(x - 3y) + (2x - y) + (4y - 3x)][(x - 3y)^2 + (2x - y)^2 +, \text{ etc.}]$$
$$= 0 \times [(x - 3y)^2 + (2x - y)^2 + \quad]$$
$$= 0.$$

From this the required result at once follows.

(3) Factorize $a^4 + 64$.

$$a^4 + 64 = a^4 + 16a^2 + 64 - 16a^2$$
$$= (a^2 + 8)^2 - 16a^2$$
$$= (a^2 + 4a + 8)(a^2 - 4a + 8).$$

(4) Find c in order that $x^2 + a^2 + 4 + 2ax + 4x + c$ may be a perfect square.

Proceeding in the ordinary method,

$$x^2 + 2x(a + 2) + a^2 + 4 + c \;|\; x + a + 2$$
$$x^2$$
$$2x(a + 2) + a^2 + 4 + c$$
$$2x + (a + 2) \;|\; 2x(a + 2) + a^2 + 4 + 4a$$

From which we see that $c = 4a$.

(5) Prove $a^3(b - c) + b^3(c - a) + c^3(a - b) \equiv -(a - b)(b - c)(c - a)(a + b + c)$.

In $a^3(b - c) + b^3(c - a) + c^3(a - b)$ put $a = b$

it becomes $= b^3(b - c) + b^3(c - b) = 0$;

∴ $a - b$ is a factor.

Similarly $c - a$ and $b - c$ are factors.

Thus $(a - b)(b - c)(c - a)$ are 3 factors of the left hand side, there is thus one more simple factor to find, which, moreover, will be symmetrical in a, b and c, etc., since $a^3(b - c) + b^3(c - a) + c^3(a - b)$ is symmetrical.

This fourth factor is therefore $a + b + c$;

$$\therefore\ a^3(b - c) + b^3(c - a) + c^3(a - b) = k(a - b)(b - c)(c - a)(a + b + c).$$

Taking the particular case of $a = 1$, $b = 2$, $c = 3$, we see that for this equation to be true $k = -1$.

$$\therefore\ a^3(b - c) + b^3(c - a) + c^3(a - b) = -(a - b)(b - c)(c - a)(a + b + c).$$

Euclid Course for November.

The first two books should be carefully revised.

Hints on October riders:

(1) The square on the diagonal of a square is equal to twice the square on a side. Referring to the figure of II. 14, as given in Hall and Stevens, $BD^2 = BE^2 + ED^2$ $= BE^2 + EF^2 = 2BG^2 + 2GE^2 = 2GH^2 + 2GE^2$ $= 2EH^2 + 4EG^2$; that is, square on diagonal of rectangle is larger than that on diagonal of square by 4 times square on EG.

(2) Let x = number of degrees in the angle.

Then $x + 2x + 2x = 180°$, or $x = 36°$.

(3) Since angles ABD, AED, are both right angles;

∴ ABDE is a quadrilateral in a circle;

∴ PE, PD = PA, PB = constant.

Work the following riders:

(1) Construct a right-angled triangle, having given the hypotenuse and the difference of the remaining sides.

(2) Show how to draw from two points, A and B, two lines AP, PB, meeting a given straight line CD in P, so that angles APC, BPD, are equal.

(3) Show that the sum of AP and PB is less than the sum of any other two lines drawn from A and B to any other point in CD.

MECHANICS.

Course for November.

The chapter on Centre of Gravity should be read up. A definition of centre of gravity; a proof that a body can only have one centre of gravity; an experimental method of finding the centre of gravity of a body; a proof that the centre of gravity of a triangle is ⅔ of way down a median—all this should be carefully studied.

The Hydrostatics should be continued, and examples worked; the barometer and the pumps will want attention.

We append examples:—

(1) 3 c.c. of water are mixed with 2 c.c. of a liquid; S.G. 1·3; find S.G. of mixture.

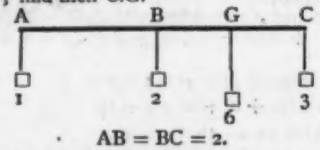
The water has a volume 3 c.c.; S.G. = 1; and ∴ weight = 3 grms.

The other liquid volume = 2 c.c.; S.G. = 1·3; and ∴ weight = 2·6 grms.

∴ mixture has volume 5 c.c., and weight 5·6 grms.

Hence spec. grav. $= \frac{5{\cdot}6}{5} = 1{\cdot}12$.

(2) Masses of 1 lb., 2 lbs., 3 lbs., are placed in a row each 2 feet apart; find their C.G.



$$AB = BC = 2.$$

Let G be C.G., where 6 lbs., the resultant weight, may be supposed to act.

Taking moments about A.

$$2AB + 3AC = 6AG,$$

or $$6AG = 4 + 12 = 16,$$

or $$AG = 2\tfrac{2}{3} \text{ ft.}$$

(3) A mass of 6 lbs. hangs vertically by a string; a second string is attached to it, and is pulled by a horizontal force F, till the former string makes an angle 60° with the vertical. Find F and tension of string.

Let AB be vertical through A, the point from which the string hangs.

Let AC be string in its new position, so that $\angle BAC = 60°$.

And CB horizontal through the mass at C.

Then C is acted on by 3 forces, viz.:—

(1) T the tension of string along CA.

(2) 6 lbs. its weight vertically down.

(3) The horizontal force F along BC.

The triangle CAB having its sides parallel to these forces respectively, is triangle of force.

Hence $6 : F : T = AB : BC : CA$

$= 1 : \sqrt{3} : 2$; since $\angle BAC = 60°$.

Hence $F = 6\sqrt{3}$ lbs.
$T = 12$ lbs.

CHEMISTRY.

Course for November.

The past work should be revised carefully. The chapter on combustion and the nature of flame needs study.

Get up a careful definition, with examples, of acids, bases, and salts.

Some old papers should be worked through with the help of text-books.

Correspondence.

Teachers wishing to have their test papers corrected should send the same addressed to the 'Matriculation Editors,' care of Joseph Hughes and Co., Froebel House, St. Andrew's Hill, Doctors' Commons, London, E.C., and enclose a remittance of 6d. for each paper.

Students desiring to have the papers set in previous numbers corrected can have them corrected on the same conditions.

The Matriculation Editors will be pleased to reply briefly through these columns to those seeking advice.

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Personal Property—'ANXIOUS.'—(1) By a deed of gift; (2) You should employ a good local solicitor; (3) The cost should not exceed £5.

Income Tax—'R. G. M.'—Yes, the assessment appears to be fair. I advise you to pay the sum demanded.

'Begging the Question'—'T. L. G.'—No wonder you do not understand this much misused phrase. It is no uncommon occurrence for a disputant who is being worsted in the argument to say to his opponent, 'Oh, but you are begging the question,' when he is doing nothing of the kind. To beg the question, is to assume as true, that which you are striving to prove. Thus, you lay down as the proposition to be proved, 'Parallel lines will never meet.' You then attempt to prove this by stating they will never meet because they are parallel. Immediately the rules of logic step in and state that this argument is fallacious. This fallacy is so common, that logicians have given it a special name, *petitio principii*, or 'Begging the Question.'

Women Teachers in Boys' Schools—'A NEW WOMAN.'—The Education Department are 'not disposed to look with favour on this arrangement.' They 'consider it very far from desirable that young women should be employed in a boys' school with its ordinary staff, unless a more complete supervision than is ordinarily practicable or possible be exercised by the managers.'

I agree with 'My Lords.' If the employment of women in boys' schools were permitted, parsimonious managers and boards would employ them largely, at a cheaper rate than men, and thus add considerably to the crowd of unemployed men teachers.

Debt—'L. G.'—You can sue in the County Court for the district in which the debtor either resides or has his place of business.

Debt—'WIDOW.'—You are not liable to pay the debts of your deceased husband, if you have not retained any of his property. If you have any property, whether lands, house, furniture, or clothes, in fact property of any kind, you must either deliver it to the creditors, or pay to them its value.

Scholarship Examination—'F. M.'—No extra marks will be awarded at the Scholarship Examination, to be held in December 1895, for a certificate in Physiography obtained at the May examinations in 1894.

Scholarship Examination—'G. E. W.'—The answer I gave last month was based on an official decision of the Education Department. By it, the Department merely signify that they will *permit* such a course to be followed. They cannot, however, *compel* the authority of a training college to admit as a student a Queen's scholar who avails himself of this privilege.

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Mental Arithmetic. Standards I.–VII. London: The Education Union.

When a work on mental arithmetic supplies us with good, suitable examples, and, in addition, provides useful hints as to quick solution of typical problems, very little is wanting to make it perfect. That the volume now before us does this, and does it well, is the opinion we have arrived at after a careful perusal thereof. We know of no book on the subject more likely to suit the wants of young teachers, and of older teachers seeking something fresh in the way of examples, than the one we are now examining.

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French Stories. By Marguerite Vinet. Blackie's Modern Language Series.

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Blackie's Combined Standard Arithmetics for Course "S." Nos. 1, 2, and 3. London: Blackie and Son, Limited.

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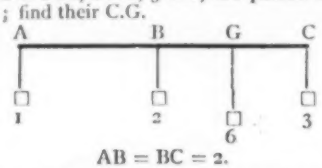
(2) Masses of 1 lb., 2 lbs., 3 lbs., are placed in a row each 2 feet apart; find their C.G.



$AB = BC = 2$.

Let G be C.G., where 6 lbs., the resultant weight, may be supposed to act.

Taking moments about A.

$$2AB + 3AC = 6AG,$$

or $$6AG = 4 + 12 = 16,$$

or $$AG = 2\tfrac{2}{3} \text{ ft.}$$

(3) A mass of 6 lbs. hangs vertically by a string; a second string is attached to it, and is pulled by a horizontal force F, till the former string makes an angle 60° with the vertical. Find F and tension of string.

Let AB be vertical through A, the point from which the string hangs.

Let AC be string in its new position, so that $\angle BAC = 60°$.

And CB horizontal through the mass at C.

Then C is acted on by 3 forces, viz.:—

(1) T the tension of string along CA.

(2) 6 lbs. its weight vertically down.

(3) The horizontal force F along BC.

The triangle CAB having its sides parallel to these forces respectively, is triangle of force.

Hence $6 : F : T = AB : BC : CA$
$= 1 : \sqrt{3} : 2$; since $\angle BAC = 60°$.

Hence $F = 6\sqrt{3}$ lbs.
$T = 12$ lbs.

CHEMISTRY.

Course for November.

The past work should be revised carefully. The chapter on combustion and the nature of flame needs study.

Get up a careful definition, with examples, of acids, bases, and salts.

Some old papers should be worked through with the help of text-books.

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REVIEWS.

Mental Arithmetic. Standards I.–VII. London: The Education Union.

When a work on mental arithmetic supplies us with good, suitable examples, and, in addition, provides useful hints as to quick solution of typical problems, very little is wanting to make it perfect. That the volume now before us does this, and does it well, is the opinion we have arrived at after a careful perusal thereof. We know of no book on the subject more likely to suit the wants of young teachers, and of older teachers seeking something fresh in the way of examples, than the one we are now examining.

The Cinderella Poetry Book. By Annie A. Smith. London: Blackie and Sons.

The verses contained in this taking little booklet are suited to the capacity of the little ones for whom they are intended, both as regards subjects chosen and language. If the versification does not smack of Tennyson or Browning, it is still endowed with a musical jingle which will commend itself to the infants whose tastes and predilections had to be considered when the book was compiled.

Typical Mental Problems, Standards II. to V. (*a*) Scholars' Edition without answers, (*b*) Teachers' Edition with answers. London: Blackie & Sons.

Complaint is still made by H.M. Inspectors concerning the mechanical way in which arithmetic is taught in the schools. Certain it is that one of the best corrections to this serious blemish is free and full use of mental work. The little books now under review are eminently calculated to assist in making this mental work thorough and varied. Four or five typical classes of examples are given, and copious examples in illustration of each are supplied. For the way in which the aim of the author has been carried out we have nothing but praise, and we shall not be surprised if these little books become great favorites.

Joseph Addison: Papers on Roger de Coverley from the 'Spectator,' with Introduction and Notes by Frances E. Wilcroft. London: Blackie and Son, Limited.

This is a very neat little volume in the publishers' series of English Classics. It contains 12 of the charming essays in which Addison depicts the ideal country gentleman of the early part of the last century. The introduction consists of a simple and easily written sketch of the life of Addison, and a short account of his successful paper, the *Spectator*. The notes are suitable for young readers, and will serve well to explain difficulties, to throw light on old-time allusions, and to add to the interest of reading these delightful papers.

French Stories. By Marguerite Vinet. Blackie's Modern Language Series.

These stories are well adapted for beginners. The notes are very good, without being too full. The exercises for retranslation at the end of the book form a very good feature of it. The idea of prefixing to a book of this kind for beginners a *resumé* of difficult points in French grammar is commendable. This book should meet with a ready sale.

Blackie's Combined Standard Arithmetics for Course "S." Nos. 1, 2, and 3. London: Blackie and Son, Limited.

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